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THE AMERICAN

GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LVI.—No. 18. Whole No. 882. | NEW YORK, MONDAY, MAY 2, 1892. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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[OFFICIAL NOTICE.]

Fifteenth Annual Meeting, Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION,
QUINCY, ILLS., April 4th, 1892.

The Fifteenth Annual Meeting of the Western Gas Association will be held at Detroit, Mich., on the 18th, 19th and 20th days of May. The Russell House has been designated by the Committee of Arrangements as the headquarters of the Association, while the business sessions will be conducted in the Armory of the Detroit Light Infantry, two blocks distant from the Russell House. The proprietor of the Russell House, Mr. W. H. Chittenden, will take pleasure in reserving rooms for those who may apply in advance of the date of the meeting; and as the gentleman in question, aside from being the proprietor of the hotel, is also one of the Directors of the Detroit Gas Light Company, he will personally see to it that our members are housed in the way that gas men should be accommodated. The Russell House is conducted on the American plan, and the rates for members in attendance, their families and friends, will be $3 per day and upwards, according to location of rooms.

Your Secretary takes this occasion of stating that although no published announcement of the fact has heretofore been made, the special committee for the assignment of papers assembled at St. Louis on the 20th of January last and prepared a list of topics, treatises on which the committee believes will be of interest and value to our members generally. The authors as designated by the committee, almost without exception, acquiesced in the allotment, and several of the papers are already in the hands of the printer, and the remaining ones will be on hand in ample time for printing and illustrating. The list is as follows:

"Origin of Coal and Petroleum," by Mr. Alfred E. Forstall, Newark, N. J.

"New Features in the Routine Office Work of Small Gas Companies," by Mr. Walter Lee Brown, Evanston, Ills.

"Every Day Gas Analysis," by Mr. Wm. A. Stedman, Jr., St. Louis, Mo.

"The Advantages of Recuperative Furnaces in the Utilization of Heat," by Mr. Fred. Bredel, Milwaukee, Wis.

"Petroleum Products—Hydrocarbon Employed in Gas Manufacture," by Mr. C. M. Higgins, New York, N. Y.

"Fuel Gas as Viewed Through a Coal Gas Man's Spectacles," by Mr. K. M. Mitchell, St. Joseph, Mo.

"Practical Photometry Simplified for Daily Use," by Mr. B. E. Chollar, St. Louis, Mo.

"The Construction and Operation of Half-Depth Regenerative Furnaces for Firing with Cheap Coal," by Mr. W. H. Odiorne, Springfield, Ills.

It is this manifestation of willingness and zeal for the welfare of "The Western," and hearty and favorable response to requests for the preparation of papers, that lighten the labors of the officers of the Association and contribute so much to a successful meeting.

While the "Question-Box" has long since lost the charm of novelty, there is a feeling on the part of many of our members that our Association has never given this feature of its proceedings the prominence to which its importance entitles it. It has been suggested that we use our best efforts to make this one of the leading features of the Detroit Meeting. It is presumed that the main reason why the Question-Box has been slurred over with us in the way that it has is because the queries were usually put on the spur of the moment, and were as hastily, and, therefore, unsatisfactorily, answered. It is, therefore, recommended that on this occasion our members be requested to send to the Secretary, as far in advance of the date of the meeting as possible, the questions to which they wish replies. Such queries will be promptly announced in these columns, unaccompanied by the names of the senders, thus enabling those who desire to reply to properly prepare and duly weigh their answers before taking the floor for that purpose.

The annual membership list is now printed; and each of our members should have received a copy on the 20th of this month. If those who failed to receive a list will kindly notify the Secretary the omission will be cheerfully supplied. Application blanks will be mailed to those who may be desirious of joining our Association at its next meeting.

A. W. LITTLETON, Sec.

PROGRESS IN ROLLING UP THE FUND.

Up to Thursday of last week additional subscriptions to the exhibit of the gas industry at the World's Fair under the management of the Gas Industry Council were reported, amounting to $6,996. The subscribers' names together with the amounts subscribed will be found in their appropriate places in the appended list. The subscription of the Williamsburgh Gas Light Company, of Brooklyn, N. Y., which amounts to $2,000, was omitted in the list given last week from an oversight. An examination of the record shows that the pledge was given on April 8. The total sum now actually and unreservedly pledged amounts to $35,785.28, and several thousand dollars more are, as was said in our last, to all intents and purposes as good as pledged. We urge upon our subscribers the necessity that exists for prompt and liberal action in this matter. And we urge it on the ground that every gas company and every member and firm of the allied manufacturing interests can count with surety on the return eventually of far more money than that which they contribute. If the plans of the Council are carried out—and if they are given the money they will be to a certainty—the gas building and its equipment will do more towards popularizing gas for purposes other than lighting—to say nothing of the enlargement of the latter field that is sure to result—than can well be estimated. The additional subscriptions carry the name of one Company that evidently fully appreciates the situation—the Millville (N. J.) Company, sending out less than 10 millions cubic feet per annum; its proprietors are confident enough in their spirit of fraternity to subscribe $200. It is a big, broad, subscription, and does them credit. The full list is appended:

Date.	Name and Location of Subscriber.	Sum.
Mar. 11.	Charles H. Nettleton, Birmingham, Conn.	$100 00
" 12.	D. E. Fleming, Fredericksburg, Va.	10 00
" 14.	Kenton Gas and Elec. Co., Kenton, Ohio.	16 00
" 14.	New Gas Light Co., Janesville, Wis.	50 00
" 15.	Abiel Heilman, Allentown, Pa.	100 00
" 16.	Hagerstown Light & Heat Co., Hagerstown, Md.	20 00
" 17.	Newark Gas Light Co., Newark, N. J.	1,000 00
" 17.	Port Jervis Gas Co., Port Jervis, N. Y.	10 00
" 18.	The Gas and Electric Light Co., Lincoln, Ill.	40 00
" 19.	St. Joseph Gas and Mfg. Co., St. Joseph, Mo.	200 00
" 21.	Dedham and Hyde Park Gas and Electric Light Co., Dedham, Mass.	20 00
" 21.	Marblehead Gas & Elec. Lt. Co., Marblehead, Mass.	10 00
" 21.	Danvers Gas Lt. Co., Danvers, Mass.	10 00
" 21.	Madison Gas Lt. and Coke Co., Madison, Wis.	75 00
" 21.	Consumers Gas Co., Toronto, Ont.	2,000 00
" 23.	Seattle Gas, Elec. and Motor Co., Seattle, Wash.	200 00
" 24.	Clinton Gas Lt. Co., Clinton, Mass.	32 00
" 24.	United Gas Improvement Co., Phila., Pa.	10,000 00
" 28.	Ithaca Gas Lt. Co., Ithaca, N. Y.	25 00
" 28.	AMERICAN GAS LIGHT JOURNAL, New York City.	250 00
" 29.	Washington Gas Lt. Co., Washington, D. C.	2,500 00
" 29.	Connelly Iron Sponge & Governor Co., N.Y. City.	100 00
" 29.	Norwich City Gas Co., Norwich, Conn.	75 00
" 29.	D. McDonald & Co., Albany, N. Y.	500 00
" 29.	Bath Gas Co., Bath, N. Y.	25 00
" 29.	College Point Gas Co., College Point, N. Y.	20 00
" 29.	Auburn Gas Lt. Co., Auburn, N. Y.	50 00
" 29.	Binghamton Gas and Elec. Co., Binghamton, N.Y.	250 00
" 29.	Leominster Gas Lt. Co., Leominster, Mass.	10 00
" 29.	Richmond Gas Co., Richmond, Ind.	160 00
" 29.	Brattleboro Gas Lt. Co., Brattleboro, Vt.	20 00
" 29.	Newton Gas Lt Co., Newton, N. J.	10 00
" 29.	Geneva Gas Lt. Co., Geneva, N. Y.	25 00
" 29.	Nyack Gas Works. Nyack, N. Y.	8 00
" 29.	Athens Gas Lt. and Elec. Co., Athens, O.	20 00
" 29.	Mansfield Gas Lt. Co., Mansfield, O.	60 00
" 29.	Watertown Gas Lt. Co., Watertown, N. Y.	52 00
" 29.	J. F. Seamon, Uniontown, Pa.	10 00
" 30.	Anniston Gas and Lt. Co., Anniston, Ala.	10 00
" 30.	Monmouth Gas Co., Monmouth, Ills.	20 00
" 30.	Chas. J. Hayes, Palatka, Fla.	5 00
" 30.	Michigan City Gas Co., Michigan City, Ind.	50 00
" 30.	Bethlehem Gas Co., Bethlehem, Pa.	25 00
" 30.	Maryland Meter and Mfg. Co., Baltimore, Md.	250 00
" 30.	Hudson County Gas Lt. Co., Hoboken, N. J.	380 00
" 30.	Mt. Vernon Gas Lt. and Coke Co., Mt. Vernon, O.	40 00
" 30.	Providence Gas Co., Providence, R. I.	500 00
" 30.	Hamilton Gas Lt. Co., Hamilton, Ontario.	232 00
Mar. 30.	Cobourg Gas Co., Cobourg, Ontario.	$12 00
" 30.	Citizens Gas Lt. Co., Newark, N. J.	250 00
" 30.	North Adams Gas Lt. Co, North Adams Mass.	75 00
" 30.	Windsor Gas Co., Windsor, Ontario.	50 00
" 30.	Buffalo Mutual Gas Lt. Co., Buffalo, N. Y.	200 00
" 30.	Quincy Gas Lt. and Coke Co., Quincy, Ills.	200 00
" 30.	Warren Gas Lt. Co, Warren, O.	40 00
" 31.	Nashua Lt., Heat and Power Co., Nashua, N. H.	100 00
" 31.	Akron Gas Co., Akron, O.	75 00
" 31.	Piqua Gas Lt. and Coke Co., Piqua, O.	35 00
" 31.	Urbana Gas Lt. and Coke Co., Urbana, O.	40 00
" 31.	Port Huron Gas Lt. Co., Port Huron, Mich.	40 00
" 31.	Winsted Gas Co., West Winsted, Conn.	8 00
" 31.	James Slade, Yonkers, N. Y.	25 00
" 31.	South Bend Gas Co., South Bend, Ind.	50 00
" 31.	C. S. Lowe Gas and Elec. Co., Colo. Springs, Col.	25 00
April 1.	Charlotte Gas Co., Charlotte, Mich.	15 00
" 1.	Jackson Gas Lt. Co., Jackson, Cal.	5 00
" 1.	Belfast Illuminating Co., Belfast, Me.	5 00
" 2.	Washington Gas Lt. Co., Washington C. H., O.	10 00
" 2.	Coshocton Gas Works, Coshocton, O.	14 00
" 2.	Bridgeton Gas Lt. Co., Bridgeton, N. J.	50 00
" 2.	Norwalk Gas Lt. Co., Norwalk, Conn.	56 00
" 5.	Lambertville Gas Lt. Co., Lambertville, N. J.	20 00
" 7.	Steubenville Gas and Elec. Co., Steubenville, O.	100 00
" 7.	Portland Gas Lt. Co., Portland, Ore.	300 00
" 8.	Little Falls Gas Lt. Co., Little Falls, N. Y.	50 00
" 8.	Williamsburgh Gas Lt. Co., Brooklyn, N. Y.	2,000 00
" 11.	Joliet Gas Lt. Co., Joliet, Ills.	50 00
" 11.	Walla Walla Gas and Elec. Co., Walla Walla, Wash	20 00
" 12.	Deily & Fowler, Philadelphia, Pa.	300 00
" 12.	Keystone Meter Co., Royersford, Pa.	100 00
" 12.	R. D. Wood & Co., Philadelphia, Pa.	2,000 00
" 12.	Vineland Gas Works, Vineland, N. J.	12 00
" 12.	McKeesport Gas Co., McKeesport, Pa.	50 00
" 12.	Shamokin Gas Lt. Co., Shamokin, Pa.	13 28
" 13.	Johnstown Gas Co., Johnstown, Pa.	50 00
" 13.	B. Kreischer & Sons, New York City.	200 00
" 13.	Adam Weber, New York City.	200 00
" 13.	Middletown Gas Co., Middletown, O.	15 00
" 13.	Zanesville Gas Lt. Co., Zanesville, O.	160 00
" 13.	Flushing Gas Lt. Co., Flushing, N. Y.	40 00
" 13.	La Crosse Gas Lt. Co., La Crosse, Wis.	25 00
" 13.	Huntsville Gas Lt. and Coke Co., Huntsville, Ala.	48 00
" 14.	Pittston Gas Lt. Co., Pittston Pa.	32 00
" 14.	Citizens Gas Lt. Co., Brooklyn, N. Y.	800 00
" 14.	Oberlin Gas and Elec. Co., Oberlin, Ohio.	12 00
" 14.	Bartlett, Hayward and Co., Baltimore, Md.	1,000 00
" 14.	Springfield Gas Lt. & Coke Co., Springfield, Ohio.	200 00
" 14.	Shelbyville Gas Lt. Co., Shelbyville, Ind.	20 00
" 14.	Beloit Gas Lt. and Coke Co., Beloit, Wis.	25 00
" 14.	Moses G. Wilder, Philadelphia, Pa.	50 00
" 14.	Society of Gas Lighting, New York City.	250 00
" 14.	Fort Scott Lt. and Fuel Co., Fort Scott, Kas.	50 00
" 14.	Rock Island Gas Co., Rock Island, Ill.	50 00
" 15.	D. W. Hunt and Son, Fort Dodge, Io.	10 00
" 15.	Frederick Egner, New York City.	25 00
" 15.	Peoples Lt. and Fuel Mfg. Co., Moline, Ill.	40 00
" 16.	Newburyport Gas & Elec. Co., Newburyport, Mass.	36 00
" 16.	Consolidated Gas Co., Baltimore, Md.	1,000 00
" 16.	Schneider and Trenkamp Co., Cleveland, Ohio.	300 00
" 16.	Clark & Co., Geo. M., Chicago, Ills.	500 00
" 18.	South Side Gas Co., Pittsburg, Pa.	181 00
" 19.	Logan Iron Works, Brooklyn, N. Y.	500 00
" 19.	Columbus Gas Lt. & Coke Co., Columbus, O.	500 00
" 19.	American Meter Co., New York, N. Y.	1,000 00
" 20.	Westmoreland Coal Co., Philadelphia, Pa.	1,000 00
" 20.	Hartford City Gas Lt. Co., Hartford, Conn.	456 00
" 20.	American Tubing & Webbing Co., Providence, R. I.	20 00
" 21.	Chillicothe Gas Lt. & Water Co., Chillicothe, O.	50 00
" 21.	Morton Iron Works, Brooklyn, N. Y.	250 00
" 23.	John J. Griffin & Co., Philadelphia, Pa.	500 00
" 23.	Adrian Gas Lt. Co., Adrian, Mich.	20 00
" 26.	Millville Gas Lt. Co., Millville, N. J.	200 00
	Total.	$35,785 28

[Translated for the JOURNAL, from the *Journal des Usines a Gaz*, by Mr. C. S. Davis.]

An Examination of the Washers at the Elberfield Gas Works.

By Dr. BUEB, Chemist to the German Continental Gas Company.

At the request of the Berlin-Anhalt Machine Company, I undertook a series of tests of the washers at the Elberfield gas works, during January and February of last year. The results of this examination have an especial interest from the fact that the separation of the ammoniacal gas is accomplished, in one half the Elberfield works, entirely by means of washers; there being no scrubbers interposed between the washers and the hydraulic main. Furthermore, throughout two-thirds of the plant the "plunge" is done away with.

The gas on leaving the hydraulic passes into the condenser; from there into the extractor, and thence into a Drury tar washer, where it separates into two washers placed side by side, each capable of a maximum production of 636,000 cubic feet of gas per 24 hours. These tests were made with a view to determining the power of the washers for the extraction of the ammoniacal gases in the three following cases:

1st. When the total production (call it 1,060,000 cubic feet per day) has been passed through 2 washers at a time.

2d. When it has been passed through a single washer.

3d. When its maximum quantity (636,000 cubic feet) has been passed through a single washer.

The composition of the ammoniacal liquor at 2.8° B. was:

Total quantity of ammoniac	2.397	per cent.
Volatile ammoniac	2.363	" "
Fixed ammoniac	0.034	" "
Carbonic acid	2.090	" "
Total quantity of sulphur	1.200	" "
Chlorine	0.054	" "
Sulphuric acid	Traces.	

The following data may be obtained from these figures by taking the series I-B as a basis, as representing the ordinary progress of the work. From I-B it may be seen that 229.6113 grains of ammoniac are extracted from each 100 cubic feet of gas passing through the washer. From the analysis below, we see that these 229.6113 grains are contained in .65 quart of ammoniacal liquor at 2.8° B. Consequently, we find that there is a production, per 100 cubic feet of gas passing through these Elberfeld washers, of .65 quart of ammoniacal liquor at 2.8° B., containing:

Ammoniac	227.75805 grains.
Carbonic acid	198.37220 "
Sulphur	113.92037 "

It follows from the table that the degree to which the washer extracts the ammoniac is in a direct ratio to the concentration of the ammoniacal liquor produced.

TABULATION OF THE EXPERIMENTS.

	I. In Passing the Total Production—say 1,060,000 Cu. Ft.—Simultaneously through Two Washers.		II. In Passing the Total Production—1,060,000 Cubic Feet—through a single Washer.		III. In Passing 636,000 Cubic Feet per 24 Hours through a Single Washer.	
	A.	B.	A.	B.	A.	B.
Quantity of gas passing through the washers in 24 hours, in cubic feet	1,060,000	1,060,000	1,060,000	1,060,000	636,000	636,000
Fall of pressure in the washer, in inches	.23622	.23622	.7874	.7874	.15748	.15748
Temperature of the water as fed, in degrees Fahrenheit	46.4	46.4	46.4	46.4	46.4	46.4
Temperature of the water at the vent, in degrees Fahrenheit	51.8	53.6	50.0	51.8	51.8	53.6
Temperature of the gas at its entry into the washer, in degrees	57.2	57.2	57.2	57.2	57.2	57.2
Quantity of ammoniac per 100 cubic feet, before entering the washer, in grains	228.1475	231.5775	227.1981	233.9706	218.4613	221.0819
Quantity of ammoniac per 100 cubic feet, after leaving the washer, in grains	.83452	1.96615	1.22775	5.24309	1.32388	3.32061
Density of the ammoniacal liquor, in degrees Baume	1.2	2.8	1.2	2.8	2.7	3.8
Strength of the ammoniac, in grains per quart	128.5599	350.0255	148.0709	332.8458	298.8404	410.3346
Quantity of ammoniac obtained (per cent. of total quantity)	99.6	99.2	99.4	97.7	99.2	98.5

In the annexed tables, the results given in the column headed I-A have been arrived at by extracting the ammoniac gas as completely as possible, without paying any heed to the consistency of the solution obtained.

The column headed I-B indicates the results obtained when ammoniacal liquors of from 2.5° to 3° B. are produced, as is the case in actual working. The tests the results of which are given in the columns headed II-A and II-B are the same as those for the columns I-A and I-B, except that the total production is passed through a single washer. Finally, those headed III-A and III-B furnish the results given by the washer when the maximum quantity of gas for which it is designed has been passed through it. The results have been very encouraging, for experience has shown that a singler washer is sufficient to extract almost all the ammoniac from the entire production of gas; that is to say, from double the quantity of gas that it was designed to treat.

According to the results shown in the column headed I-B, under normal conditions, the strength of the ammoniacal liquor in the separate chambers has been as follows:

	Degrees, B.	Ammoniac, in Grains.
Chamber 1.	Water at 2.8°	350.0255 per quart.
" 2.	" " 2.0°	257.3339 " "
" 3.	" " 1.6°	182.3871 " "
" 4.	" " 1.2°	124.1225 " "
" 5.	" " 0.8°	79.4384 " "
" 6.	" " 0.5°	47.1666 " "
" 7.	" " 0.3°	17.0851 " "

The results given in column II-A, show that a single washer can purify almost wholly 1,060,000 cubic feet of gas per day from its ammonia, without regarding the concentration of the ammoniacal liquor produced, which is, in this case, really too slight to be of use afterward. On the other hand, when a solution of 2° to 3° B. thoroughly concentrated is produced, the action of the washer is still very good, for it is capable of carrying off 99.2 per cent. of ammoniac from 636,000 cubic feet of gas per day (III-A), or 97.7 per cent. from 1,060,000 cubic feet.

In consequence, the washer is relatively an apparatus of considerable capacity, as it is capable of accomplishing results that could only be effected through a long series of scrubbers. Besides this, the management of the apparatus is extremely simple, and merely consists in regulating the feed of water so as to give to the ammoniacal liquor exactly the concentration desired. The expenses, too, will be found to be but little higher than those necessary in constantly running a pump to feed the scrubbers with water.

The Collins Gas Making Apparatus.

On the 12th inst. U. S. Letters Patent (No. 472,785) were granted to Mr. Charles R. Collins, of Philadelphia, for an improved process of manufacturing gas—the inventor assigned the same to the United Gas Improvement Company.

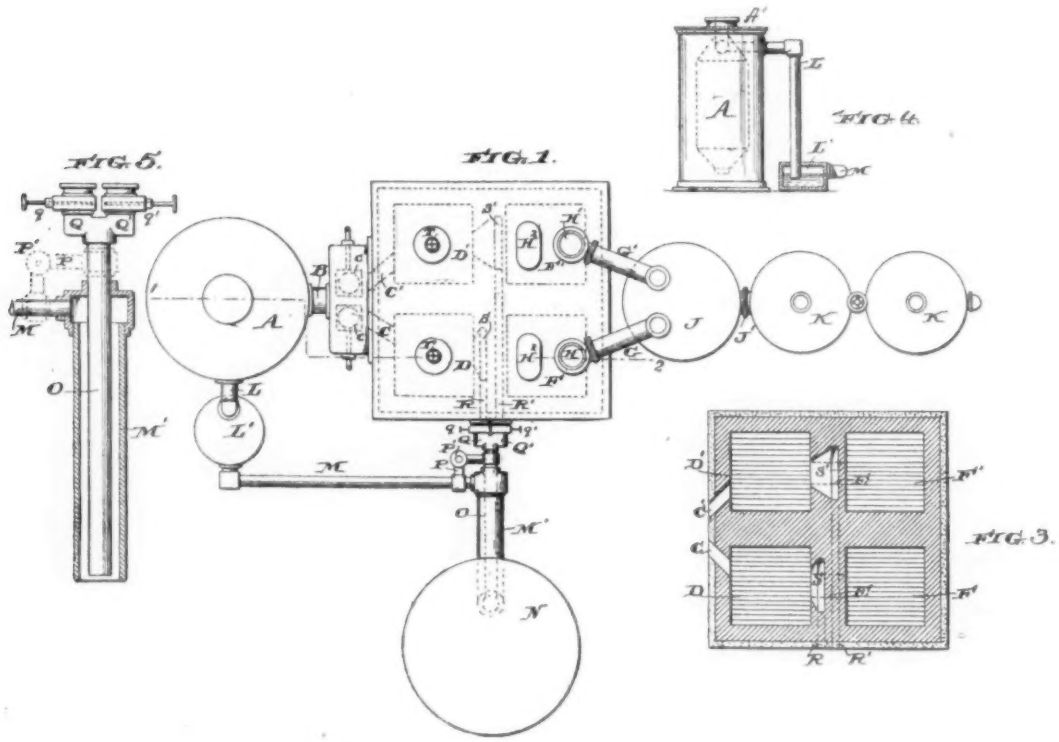
Using the words of the specification, Mr. Collins says:

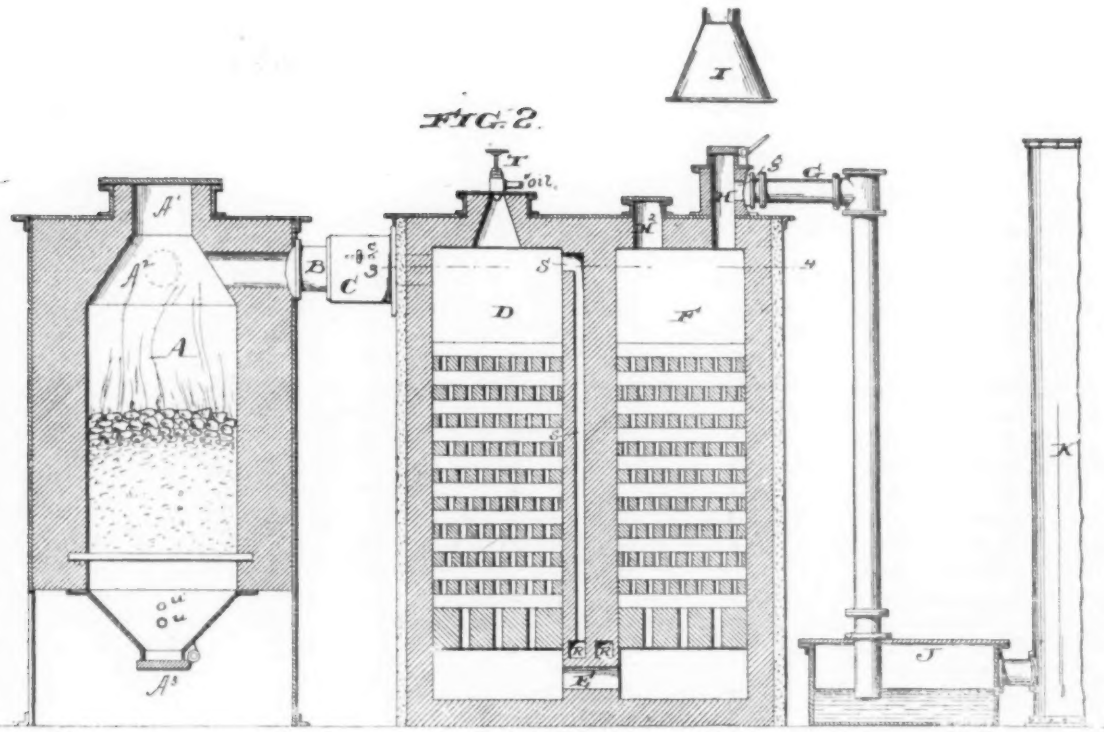
My invention relates to the construction of apparatus for the manufacture of carbureted water gas, and has for its object to provide an apparatus in which the process of carbureting and fixing the water gas

may go on continuously, while the generator forming part of the apparatus is run intermittently, alternately making producer gas, which is used for heating the fixing chambers, and water gas, which is carbureted in said chambers.

The leading features of my improved apparatus consist in the combination, with a generator, of two separated and independent carbureting and fixing chambers or set of chambers connecting independently with the generator, a gas receiver or relief holder connecting with the generator, conduits leading from the receiver to each carbureting and fixing chamber or sets of chambers, and valves arranged in the conduits between the generator and the carbureting and fixing chambers and between the receiver and the carbureting and fixing chambers, by which gas can be directed from the generator and relief holder to either carbureting and fixing chamber at will.

My invention will be best understood as described in connection with the drawings, in which it is illustrated, and in which Fig. 1 is a plan view of an improved apparatus constructed in accordance with my invention; Fig. 2, a sectional elevation taken on the line 1–2 of Fig. 1; Fig. 3, a plan view taken on the section line 3–4 of Fig. 2; Fig. 4, an elevation of the generator and the conduit leading from it to the receiver; and Fig. 5, a view, partly in section and on an enlarged scale, of the conduit leading from the receiver to the superheating chambers, showing the devices preferably used in connection with it. Fig. 6 is a sectional elevation taken through the receiver and a masonry wall of the carbureting and fixing chambers along the flue R'; Fig. 7, an enlarged plan, partly in section, showing the valves regulating the delivery of gas from the generator; and Fig. 8 is a section on the section line 5–6 of Fig. 7.





A is the generator of usual construction, having a charging-opening closed by a lid (see Fig. 2) at A' and a gas exit passage A^2 near its top. (Indicated by a dotted line in Fig. 2, because it is really on the side of the generator which is cut away.) A hinged gate A^3 is provided at the bottom of the generator for the removal of ashes, and below the grate an air-blast pipe U and steam pipe U' enter it. A conduit B also opens from the upper part of the generator, and, as shown, this conduit opens into a box B', which communicates through openings b b' with cham-

bers C^1 and C^2 from which in turn lead conduits or flues C C'. The passages b b' are opened or closed at will by valves c c'.

The conduits C and C' lead, respectively, to 2 separate and independent fixing chambers or sets of fixing chambers, in which the gas is carbureted and fixed. As shown, each such chamber consists of a chamber D or D', into which the gas conduits lead, and into which provision

FIG. 6.

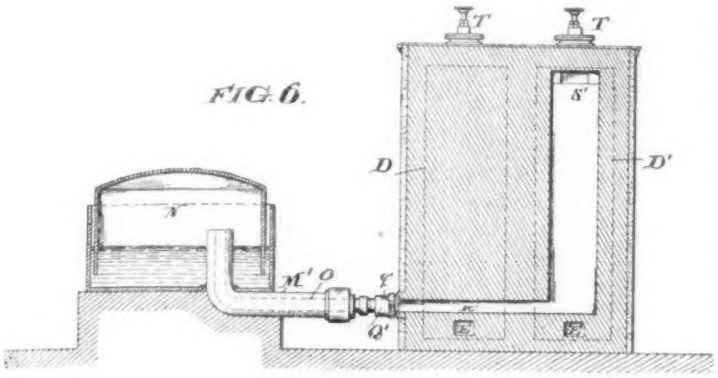


FIG. 7.

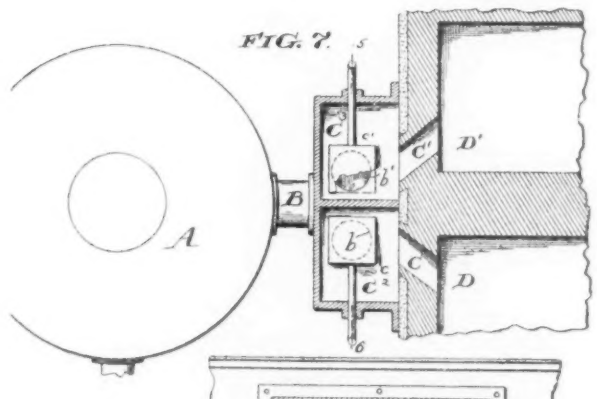
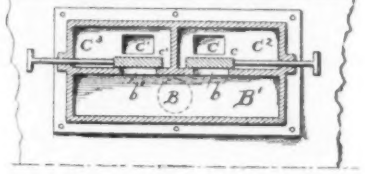


FIG. 8.



is made for introducing the carbureting material. As shown, an oil injector T is placed at the top of the chamber. The chambers D and D' should preferably be partly filled with checker work and opened at their bottoms through conduits E into fixing chambers F and F', respectively. These chambers being also filled with checker work, as shown in the drawings. From the chambers F and F' conduits H G and H' G' lead to a wash box J, which in turn communicates with scrubbers K, from which the gas is led to the place of use or storage.

Returning again to the generator, another conduit L leads from opening A^2 and through a seal-box L' and conduit M M' to a gas receiver or relief holder N. From the said receiver a pipe O leads, branching or forking at its end, as shown at Q Q', and communicating with conduits or flues R and R', formed in the masonry of the superheating chambers. The flue R communicates with the vertical flue S, which opens into the top of the chamber D, and the flue R' communicates with the vertical flue S', which opens into the top of the superheating chamber D'. Valves q and q' are provided for controlling the passage of gas from the receiver to the chambers D and D'.

In order to economize the heat of the gas coming from the generator to the receiver, I cause the delivery pipe O of the receiver to pass through the pipe M', the pipe O being thus jacketed with the hot gases coming from the generator, and I also prefer to provide a by-pass P, connecting the pipes M and O, as shown in the drawings, the said by-pass being furnished with a valve P', by which it can be opened or closed at will. This valve P' can, if desired, be an automatic valve, which will open whenever a determined amount or pressure of gas is accumulated in the receiver.

H^1 H^2 indicate openings leading into chambers F F' for cleansing them.

The operation of my improved apparatus can be readily followed. Thus, for instance, a fire being lighted in the generator and fuel, coal or coke, supplied thereto, air is forced through the fuel, and the producer gas thus produced allowed to escape through conduit B and conduits C C' into the 2 sets of carbureting and fixing chambers, in which it is burned, in order to heat the chambers, the products of combustion being allowed to escape by opening the valve at the top of pipes H H', when they will pass through said pipes into the stacks I, placed above them.

In starting the apparatus one or both of the sets of carbureting and fixing chambers can be heated at the same time. When the fuel in generator is sufficiently ignited, the air-blast is turned off and steam turned into the bottom of the generator, which, passing through the fuel, is converted into water gas. The valves c and c' having been previously closed, the water gas passes from the generator through the conduit made up of L, L' M, and M' to the receiver or relief holder N. The valves q and q' are allowed to remain closed until a sufficient amount of water gas is accumulated in the relief holder, and in the meantime, if more than one blast is required to accumulate the desired quantity of water gas, the valves c and c', or one of them, are opened whenever the steam is turned off and the air-blast turned on to the generator. A sufficient quantity of water gas having been accumulated in the receiver and the carbureting and fixing chambers having been raised to a proper temperature, the operation is continued as follows: The valve q is opened, the valve q' is closed, the valve c' opened, and the valve c closed. The air-blast being now in operation in the generator, the producer gas passes through the chambers D' and F' and escapes through the conduit H', which is opened at the same time with the valve c', the gases of course being burned in the chambers D' and F' while passing through them. At the same time water gas passes from the relief holder N through the chambers D and F, carbureting material being introduced in said chambers, as described, the carbureted gases escaping through pipe G to the washer and scrubbers, the valve at the top of pipe H being of course closed. When the blast of the generator is continued long enough, the valve c' is closed, the steam again turned into the generator, and the water gas formed in it escapes through the conduits L and L' and M and M' to the receiver N. When this run of water gas is continued sufficiently long, the steam is shut off and the air-blast again admitted to the generator. The valve c' is previously closed, the valve c opened, the valve q closed, and the valve q' opened, and at the same time the valve at the top of pipe H is also opened. The producer gas then passes through and is burned in the chambers D and F, restoring the heat previously consumed in the carbureting of the gas, and the water gas passes through chambers D' and F', and the valve at the top of pipe H' being closed the carbureted gases escape through pipe G' into the washer and scrubbers.

It will be seen that by the above described arrangement and operation I am enabled to keep a constant and practically uniform supply of water gas passing through the carbureting and fixing chambers in spite of the fact that the generator is run intermittently, manufacturing alternately producer and water gas.

During the manufacture of water gas in the generator it will often be convenient and desirable as a plan for economizing heat to pass the gases directly from the conduit M to the conduit O without first passing them into the receiver N. As a convenient device for so operating the apparatus I have shown the bye-pass P, controlled by valve P', which can be opened either by hand or automatically when a sufficient quantity of gas has been accumulated in the receiver.

It is obvious, of course, that my apparatus can be used not only in the way above described, and for which it is peculiarly adapted, but also for the manufacture and carbureting of gas in the familiar, intermittent way—that is to say, by first passing producer gas through both sets of chambers and burning it therein, and afterward passing the water gas into said chambers to be carbureted and fixed.

As shown in the drawings, the carbureting and fixing chambers are of the kind adapted to be heated by internal combustion; but it will be understood, of course, that I do not limit myself to any particular construction of the carbureting and fixing chambers, which may be constructed in accordance with any of the numerous plans now in use. I may state, however, that I decidedly prefer the plan of heating the chambers by internal combustion. The gas is forced from the generator by its own pressure and from the receiver by the weight of the dome containing it, the valves q q' regulating the delivery of gas from the receiver and being so set that the delivery is gradual.

I have in the specification and claims referred to chambers D, D', F and F' as carbureting and fixing chambers; but it will be understood that in so describing them I do not intend to limit my invention on a construction in which the oil or other carbureting material is introduced directly into the chamber, for it is familiar practice to introduce the carbureting material at various points—as, for instance, in the generator—when it passes, together with the gas to be carbureted, into the carbureting and fixing chambers.

Gas Versus Steam Engines for Motive Power.

The following is from a recent issue of the London *Journal:*

We have received from Mr. J. Emerson Dowson, M.Inst.C.E., the following particulars of a trial of a 60-horse power (nominal) Crossley gas engine, with Dowson gas plant, conducted by him at the flour-mills of Messrs. Mead and Sons, Lot's Road, Chelsea, on the 5th inst.

The maximum indicated horse power of the engine was 173.6; the estimated brake horse power, 147.6. The diameter of the cylinders was 17 inches; the length of stroke, 2 feet. The trial lasted 8 hours (from 9.40 a.m. to 5.40 p.m.) The total number of revolutions made by the crankshaft during the trial was 74,751, or 155.73 per minute. The number of explosions in the left cylinder was 25,908, or 53.975 per minute; in the right cylinder, 26,619, or 55.456 per minute. The mean pressure of the indicator diagrams of the left cylinder was 79.90 lbs. per square inch; of the right cylinder, 77.91 lbs. (1) The mean indicated horse power developed in the left cylinder during the trial was 59.30; in the right cylinder, 59.41—total, 118.71. The maximum indicated horse power which would have been developed if the engine had worked at the normal speed of 160 revolutions per minute, and fully loaded, would have been 173.6. The mean temperature of the gas in the bags near the engine was 67° F.; of the air supplied to the engine, 50° F.; of the water overflow from the left cylinder, 125° F.; of that from the right cylinder, 119° F.; and of the boiler feed water, 75° F. The mean pressure of gas in the holder was 1⅝ inches; that of the steam in the boiler, 48 lbs. per square inch. The levels of the water and the fire in the boiler, of the fire in the generator, and of the gasholder, were all the same at the end as at the commencement of the trial. (2) The quantity of anthracite consumed in the generator was 584 lbs.; that of coke in the boiler, to get up steam before the trial began, 30 lbs.; do. during the trial, 140 lbs. (3) The quantity of anthracite put in the generator on the morning after the trial, to make up for the waste during the night and when raking out clinkers, was 136 lbs., of which 30 lbs. was returned as good; leaving 106 lbs. The anthracite consumed during the trial was at the rate of 0.615 lb. per indicated horse power per hour; do. with the addition of four-fifths of that which was put in the generator on the following morning, 0.7lb.; (4) do., with the further addition of the coke used in the boiler, including the getting up of steam, 0.883 lb. The gas burnt was at the rate of about 63 cubic feet per indicated horse power per hour. (5) The anthracite consumed during the trial was about 10 lbs.; the anthracite and coke together about 12 lbs., per 1,000 cubic feet of gas made. For cooling the engine, 600 gallons of water were used, or at the rate of 5.03 gallons per indicated horse power per hour; for the boiler, 80 gallons, or 0.08 gallon per indicated horse power; for cleaning the gas, 112 gallons, or 0.11 gallon per indicated horse power per hour—making a total of 792 gallons, or 5.22 gallons per indicated horse power per hour. (6) The water used for gas making was 3.2 gallons per 1,000 cubic feet of gas produced; that evaporated in the boiler at the pressure of 48 lbs. per square inch, 4.7 lbs. per pound of coke consumed. The oil employed for the cylinders was 1½ pints at 2s. 9d. per gallon; a like quantity, at 1s. 4d. per gallon, being used for the bearings. The coal gas burnt for heating the ignition tubes was 4½ cubic feet per hour. (7) The following machines were worked during the trial: 1 pair of stones, 4 feet in diameter; 13 pairs of rolls (250 revolutions); 4 pairs of discs (600 revolutions); 14 ordinary, and 7 centrifugal silks; 4 purifiers; 24 elevators; 2 exhaust-fans; sundry conveyers; pump, shafting, etc.

Remarks.

(1) Eighteen diagrams were taken on each cylinder, at intervals of about 30 minutes. Each diagram gives the curves of 10 consecutive strokes of the indicator. The same indicator and spring were used for both cylinders. The 100-lb. spring was a new one tested by Elliott Bros., who also supplied the counters.

(2) The anthracite employed was of the usual kind, from the Gwaun Cae Gurwen Colliery Company.

(3) The coke was procured from the Gas Light and Coke Company.

(4) As the trial lasted eight hours, instead of the usual working day of ten hours, one-fifth of the waste has been deducted.

(5) The rate of gas consumed was taken by shutting the inlet of the holder, and timing the fall of the holder 6 feet while the engine was working.

(6) All the water was pumped from the river by the engine, and run to waste. Usually the water used for cooling an engine flows to and from an overhead tank.

(7) Coal gas was employed for this purpose, because Dowson gas could not be taken from the main supplying the engine, and there was no separate outlet from the gasholder.

As the greatest load which could be put on the engine during the trial was considerably less than the engine was capable of driving, and as the engine had twin cylinders, a counter was attached to the gas valve of each cylinder so as to count the admissions of gas, or, in other words, the number of explosions in each. It was not possible to determine the horse power absorbed by the friction of the engine itself, as there were no means of starting it except with belting and a long run of shafting, etc. Messrs. Crossley state that this friction does not exceed 15 per cent. of the maximum indicated horse power; and at the normal speed of 160, and with the mean pressures shown by the 36 indicator diagrams, the maximum indicated horse power was 173.6, and 15 per cent. of this is 26 horse power.

When good anthracite is used, the fire in the generator is not drawn more than once in two or three months, as the clinkers are raked out every day. At this mill it is usual to work the engine 15 hours a day without stoppage; so that the loss of fuel during the night, while the generator is standing, and when the fire is raked, should, strictly speaking, be spread over 15 hours. If the plant were worked night and day, as in paper mills and other works, there would be no such loss, except when the fires are raked once every 12 hours; and this would be very small, as all that is raked out, except the actual clinkers and ashes, is either returned to the generator or burnt in the boiler. The total quantity of water fed into the boiler during the trial was 80 gallons, or 100 lbs. per hour, including that required for the feed pump. Neither the boiler nor the steam piping was coated, and only 4.7 lbs. of water were evaporated per pound of coke consumed. The coke employed in the boiler actually weighs nearly one-fourth the anthracite used in the generator; and it may be fairly assumed that this can be improved. However, taking the plant as it stands, and as it is worked regularly day by day, the consumption of anthracite in the generator (without allowing for waste during the night) is 0.61 lb.; or, making allowance for waste, 0.7 lb. per indicated horse power per hour. Thus any mill owner who requires steam for certain purposes, and can give the small amount required for the gas plant, can get his motive power, under the gas system, with the unprecedentedly low consumption of 0.7 lb. of anthracite per indicated horse power per hour. Where anthracite cannot be procured at a moderate price, ordinary gas coke of small size can be used; but instead of 0.7 lb., it will then be necessary to use about 1 lb. per indicated horse power per hour.

It may be added that the mill was formerly worked by a non-condensing compound beam engine, and that the gas engine which has taken its place has worked regularly for nearly four months. The work of the mill varies very little; and it is satisfactory to know that the consumption of fuel during the trial agrees with the average.

[A paper read by Mr. E. C. Riley before the Southwest of England Association of Gas Managers.

The Development of Gas Lighting in Railway Carriages.

As I have only consented to fill a gap at the last moment, I will not apologize for the brevity of the paper I propose reading—especially as it can only occupy the humble position of a side dish to the great central attraction of our intellectual bill of fare to-day, the valuable and interesting paper on the "Severn Tunnel," by Mr. Richardson. I also find that the meetings of other district Associations held at this time of the year are dispensing very largely with lengthened or exhaustive papers.

I have thought it may be interesting to the members to know something of the quiet and yet important revolution that is steadily proceeding in the lighting of our railway trains. My predecessor in the Gas Department of the Great Western Railway (Mr. Botley) read a paper in June 1883 before the members of the Gas Institute, at the Firth College, Sheffield, on the "Lighting of Railway Carriages;" but the development since that date (when, at any rate as regards its application to main line trains, gas lighting was comparatively in its infancy), has been both rapid and important. I may say that at that date the "Battle of the Gases" was being fought out; and railway engineers and managers had not come to any definite conclusions as to the kind of gas and lamp most suitable to the various conditions and requirements of actual railway working.

The principal competitors for the place so long and so unsatisfactorily occupied by the oil roof lamp were: (1) coal gas uncompressed; (2) coal gas compressed; (3) coal gas compressed and carbureted; (4) cannel gas compressed; (5) oil gas compressed.

The first system referred to is the ordinary coal gas, as made and supplied in the towns in which the railway is situated, obtained from the town mains at the ordinary pressure, and stored either on the roof, under the carriages, or in the guard's van, as might be preferred. The

only survival of this system still in use on any large scale that I am aware of, exists on the North London Railway, where the comparatively short journeys and the permanently made up character of the trains lend themselves advantageously to this arrangement. On this line the gas is stored in expanding holders in a part of the van specially provided, and containing a supply sufficient for about three hours' consumption. As time is an important element in the working arrangement of London suburban trains, special provision is made for the rapid replenishing of the holders at the terminal station by flexible gas hose pipes, about 6 inches in diameter, fitted with spring ball valves and sockets, admitting instantaneous connection with the holders, which by this means can be filled in one minute. No more time, therefore, is required for gassing, nor so much, as is needed for changing engines and emptying and refilling the train with passengers. The supply of gas for each carriage is conveyed from the vans at each end of the train by pipes along the roofs of the carriages, with flexible connecting tubes between each carriage; and no regulator or governor has been used, as the pressure obtained in the holder from the mains gives an approximate burning pressure by the time it reaches the burners. The burners hitherto used have been the ordinary union type, usually about No. 4, but recently replaced by a simple regenerative burner of a useful and durable type for railway purposes. This system is efficient and useful where the trains are always made up and work regularly at short intervals into stations where a plentiful supply of good coal gas can be obtained at a pressure of not less than 3 inches, and, of course, at a reasonable price; and where the companies do not limit the effect by providing a smaller number of lights than there are compartments to be lighted, or using smaller burners than are really necessary for effectual lighting—the practical standard of efficiency being the ability to read an ordinary newspaper or book in any part of a compartment when the train is running at its highest speed.

The second system of those I have referred to as competing for the railway train lighting of the future is that of compressed coal gas. In this system we have to confront the fact of the loss due to compression necessitated by the conditions of storage essential to compliance with the requirement that each carriage shall provide, separately and independently of the rest of the train, its own supply of light—of course, in the smallest possible space, and involving the carrying of the smallest possible amount of additional weight. To comply with these conditions, iron or steel reservoirs are provided under each carriage, of a total capacity of about 20 feet at atmospheric pressure, and filled to a pressure of 6 to 9 atmospheres, according to the class of work the carriage may be employed on. The reservoirs on the carriages are filled from large stationary reservoirs, into which the gas has been compressed by special pumps from the holder to about 10 atmospheres; or from travelling reservoirs which have first obtained their supply from the stationary reservoirs, the higher initial pressure in the original receptacle providing the necessary force for filling the secondary travelling supply or the final storage vessel of each carriage. Contrary to the views of some previous writers on this subject, a considerable loss, both of bulk and illuminating power, occurs in the process of compression, in the deposition of hydrocarbon and water. From a series of tests made, in which I had the assistance of Mr. F. G. Dexter (now of Winchester), I found a loss of 49 per cent. in illuminating power in compressing to 13½ atmospheres. We were able to confirm, from our own experiments, the power of the gas to again take up a portion of the hydrocarbon deposited under pressure as the pressure is reduced; but this power is not sufficient to be any of practical value in ordinary working. I have had considerable experience during the last five years of this system; and very useful and fairly efficient results have been obtained. For about three years a train lighted in this way was running continuously for the purpose of effectually ascertaining its merits or disadvantages as compared with compressed oil gas, which was in use in other parts of the system. In experimenting with this train, I tried 14 different burners, including plain ungoverned, governor, duplex, tabletop, fish-tail and several modifications of burners of regenerative type. A long chapter could be written on these trials; but as for general working there were two important objections to the use of compressed coal gas at all (whatever might be the character of the burners or the working out of any minor details), they are of no present interest, and may be relegated to the comparative oblivion of the note books and memories of those who worked them out. The two fatal objections to compressed coal gas for railway train lighting are, first, the low illuminating power of the gas; and, second, as a result, the large amount of storage required to provide sufficient light for a long journey without the necessity for replenishing the supply occurring before reaching a station where the necessary provision is available. The most efficient and reliable result obtained was by burning 4 feet of gas through a plain No. 8 fish-tail governor burner. One of the best examples of this class of lighting may be found in the travelling post offices working between Gloucester, Swansea and Milford Haven.

The third system is one that perhaps gas engineers at present may feel the most interest in, but which has proved, so far, less amenable to the variations or special conditions of railway working. I now refer to carbureted coal gas (compressed). As every gas manager or student is aware, a great variety of carbureters have been invented, and I may say re-invented, after a sufficient interval has passed for the previous one to be forgotten or lost sight of; and it is only natural that some attempt should have been made to apply the principle to railway carriage lighting. The records of experiments in this direction do not appear to be very numerous. Mr. Bower experimented on the Great Northern Railway with both liquid and solid hydrocarbon and took out a patent; but the matter eventually dropped. Mr. Pope, of Slough, also produced a carbureter for coal gas and tried various experiments; but relinquished his efforts in that direction in favor of oil gas. Mr. Botley tried albo-carbon; but was unable to get a result that would be practically uniform and reliable under all the varying conditions of railway working. I myself made experiments and constructed a carbureter, which was subjected to a variety of tests in the laboratory; but the results were not such as to give a reasonable prospect of fulfilling the conditions necessary on a train. Any carbureted gas used for train lighting should either be raised to the standard of illuminating power of oil gas before being put into the carriage reservoir, so that no additional storage beyond present provision would be required; or else it should involve an arrangement for carbureting as used, which, so far, has proved impracticable in surmounting the difficulties of temperature, air supply and all the vicissitudes of railway working. It is also undesirable to carry on a passenger vehicle any quantity of a substance of such an inflammable character as the liquid necessary for carbureting.

The fourth system is that of cannel gas. I cannot find that much has been done with this gas in railway carriage lighting. Mr. Sugg's trials appear to have been the most noticeable. In cannel gas, as in oil gas, it is simply a question of cost and convenience. Within reasonable limits, the gas that gives the greatest amount of light with the least storage room, and consequently dead carrying weight to the train, and involves least interference with the train apparatus and working, is likely to be the favorite; and if cannel gas can be supplied at the same cost as oil gas of the same illuminating power, and with the same general convenience, there is no reason why it should not be equally valuable. But the scarcity and high price of cannel, and the possible uncertainty of its constant supply and uniform character, tend to promote the use of the plentiful petroleum or shale oil gas.

I now come to the fifth and last of the principal competitors for railway train gas lighting—I mean oil gas. Every student of gas manufacture is aware that oil gas as an illuminant has a long history; but as our subject refers only to its application to the lighting of trains, I need only mention that the system was adopted first with success in Germany in 1871, and reported on by the Committee of the Society of Arts on Railway Train Lighting as being the best existing for that purpose. The gold medal of the Society was, on the reception of the report, awarded to Julius Pintsch, of Berlin, for the practical and successful application of oil gas for the purpose of train lighting; and from this time its development has been continuous, although at first with "cautious steps and slow." The Metropolitan Company adopted Pintsch's system in 1876; since which date it has been in constant use, with unfailing satisfaction and without a hitch—at an average cost of 0.66d. per train mile, as against 1.31d. per train mile for uncompressed coal gas. Following the Metropolitan, the Great Eastern Railway, with its extensive suburban train service, adopted oil gas; and then gradually this system was taken up by the London and Northwestern, London and Southwestern and other large railway companies, until now most of the leading companies of England and Scotland have commenced applying it to some part or other of their stock.

The two firms that have taken the lead in the working out of the application of oil gas to train lighting on any large scale are Pintsch's Patent Lighting Company and Messrs. Pope & Sons, of Slough. Both of these firms have taken out patents for the lighting of railway carriages and the apparatus connected therewith, in each case including a governor or regulator for the reduction of the high pressure of 8 or 9 atmospheres, at which the gas has to be compressed in the storage holders under the carriages, to the low pressures 6-10ths or 8-10ths of water required at the point of ignition. Owing to the prominence of these firms, the terms, "Pintsch Gas" and "Pope Gas" have been so frequently used that, outside a comparatively small circle of experts or readers, who

are familiar with the principles and processes of oil gas manufacture, the impression largely obtains that gases of decidedly distinctive characteristics are meant. As a matter of fact, the gas produced by the Pintsch, Pope, Keith, or other numerous modifications of oil gas plant used by various railway companies or other firms is practically the same in general character and leading features; the differences, where they exist, being due usually to variations in the quality of oil used and the temperature of distillation.

Messrs. Pintsch and Pope both use two retorts for carbonizing—the first to crack or split up the liquid hydrocarbons, and the second to fix the vapor into permanent gas. In the former case the oil is run into the top retort first, then passed into the bottom for fixing, and conveyed downwards to a hydraulic main placed on the floor, from which it is taken to a vertical plate condenser, and then through a simple washer, and a purifier containing lime and sawdust, to the meter and holder: while in the latter system, the oil is run into the bottom retort first, then passed to the top retort, from which the gas ascends to a hydraulic main above the bed, and then on through a vertical pipe condenser to a dry scrubber or scrubbers, from which it passes to the meter and holder.

It will be seen from the brief outline just given of the general arrangement of the plant that the question of purification is much simpler than that of coal gas, owing to the almost entire absence of sulphur. Passing from the question of manufacture to that of distribution, we come at once to a different set of conditions to coal gas supply for town lighting. Oil gas for trains, in order to be in a condition available for use, must be stored at a high pressure. Consequently, the ordinary type gasholder is used only as a temporary receptacle into which the gas passes as manufactured. From this holder it is drawn by specially constructed compressing pumps (which it does not come within the scope of this paper to describe), and forced into large cylindrical steel or iron tanks or reservoirs; from which it may be either taken in travelling tanks to any point where it is required for use, or conveyed in high-pressure pipes to valves and hydrants placed in the sidings, sheds, or stations, where it will be most convenient to gas the trains. This latter process is effected by connecting a flexible pipe to the valve on either the travelling tank or high-pressure main, and connecting to the storage cylinder or holder under each carriage. We will now assume that the holder on the carriage is filled to 8 atmospheres. The high-pressure gas is then passed through a governor, reducing it to a suitable burning pressure, and from the outlet of the governor it ascends the main supply pipe to the carriage roof. On this pipe is placed the main cock, actuated by a slide rod, the handle of which is in a convenient position for working from the platform or side of the train.

We now come to the lamp itself. This, from the beginning, has invariably been placed in the roof, in the position hitherto occupied by the oil lamp; and several points of difficulty presented themselves in overcoming the varying conditions of railway working. The first point was the ventilation. It was necessary that the supply of air for combustion should be introduced in such a manner that the flame should be fed with practically the same regularity, when the train was standing still in a snug, covered, terminal station, as when rushing along a high embankment at a mile a minute, exposed to the sweep of the wind from a bleak moor or the open sea. This effect was secured in the first place by the arrangement of the holes and baffle-plates in the lamp lid, so that, however strong the current of air outside, its course to the flame was so contrived that practically no trace of the rough wind outside reached the secure stillness of the inner globe. The next point was the removal of the products of combustion into the outer air; so as to avoid any vitiation of the atmosphere of a small compartment when, from the condition of the weather, it was undesirable or disagreeable to open the windows. This result was also obtained by the special construction of the lamp lid or cover on the top of the carriage; which usually was also the only mode of access to the interior of the lamp for lighting, cleaning, etc.

I have here a section of an ordinary type roof-lamp, which illustrates the usual arrangement for ventilation and discharge of the products of combustion. It will, of course, be understood that there are many modifications in the construction of the lamp in minor details; but nothing affecting the general principle in the ordinary lamp ventilated from the outside.

We now come to the next important feature—the burner. This is a plain small steatite tip, with apertures of the union type, fitted into a brass case; the holes being proportionately small to suit a rich gas of not less than 40-candle power when compressed.

In the earlier days of train lighting with oil gas, a small flame based upon the light of a good oil lamp, when at its best, was considered a satisfactory light, as the gas had the merit of being reliable and giving a uniform light for the whole of the time it was in use; and in the early advocacy of the use of oil gas the consumption per lamp was given at one half cubic foot per hour, and calculations of cost were made accordingly. Here I think it only right to acknowledge (as every gas engineer and manager should readily admit) that we are indebted to our rival, the electric light, for raising the general standard of lighting, and setting up requirements that demand, and are insuring, that the gas lighting of trains shall be something superior to the small burner of from 3 to 6 candle power first used; and several railways that have experimented to some considerable extent with the electric light, but have now adopted gas lighting, are in consequence using larger and better lamps and burners, the consumption per burner being nearer one cubic foot than the one-half foot previously used. It was also found that, owing to the dark nature of the upholstering of the first-class carriage, the same lamp which gave a good reading light in the plainer and more slightly upholstered second and third-class was insufficient in the first. This led to two lamps being placed in each compartment, one on each side; and then to the adoption of duplex, and even triple burners, burning 1½ and 2¼ cubic feet respectively.

The next step forward in lamp construction has been to combine the the two features of lighting and ventilation in one lamp. In what I may describe as the most recent and perfect development of railway lamp, this has been effectually done by taking the air required for combustion from the inside of the carriage, and discharging the whole of the products through a fixed cover on the outside of the carriage, access to the lamp itself being obtained from inside. A lamp of this type has been adopted in the new carriages of the Great Western Railway Company, as it is specially constructed to suit the lofty omnibus ventilating roof which travellers on that line are already familiar with; and by the kind permission of Mr. Dean, the locomotive and carriage superintendent, under whose direction the new carriages are being built and fitted with gas, I have been able to provide a section showing the principle of construction, and a sample of the lamp lit with oil gas. This lamp, fitted with duplex burners, gives a light of 13¾ candles with a consumption of 1½ cubic foot of gas, as against 3 candles, which is the maximum of a good oil lamp, with a consumption of 500 grains of rape oil per hour, and affords sufficient light to read a newspaper in any part of the compartment with perfect comfort, even when the train is travelling at its highest speed.

The new corridor train built recently at Swindon, a description of which appeared a few weeks ago in the *Graphic* and other London and provincial papers, and which is now running between Paddington and Birkenhead, is fitted with this lamp.

The largest works for the manufacture of oil gas for train lighting is that recently erected for the Great Northern Railway at Holloway; and, although only working to a small proportion of its capacity, is a striking illustration of the development in the gas lighting of trains which this paper endeavors to show.

Nearly all the railway companies running into and about London and suburbs are lit with gas, and it is extending with great rapidity. The great trunk lines are fitting up their stock with gas apparatus and lamps, and soon a comfortable carriage well lit with gas will be the privilege of most railway travellers, while the old oil lamp, with its erratic behavior, so often denounced as a disappointment, a delusion and a snare, will take its place with the old stage coach and rushlight of ancient history.

By the courtesy of Messrs. Pintsch, Pope and Laidlaw, I have obtained the following figures showing the development of oil gas manufacture and lighting by these firms:

Name of Firm.	Gas Works Erected.	Railway Carriages Fitted.	Oil Gas Lamps Supplied.	Tram Cars Fitted.
Pintsch...	150	40,000	150,000*	—
Pope.....	15	10,354	40,000	90
Laidlaw..	—	—	8,000	—

* Estimated.

These figures are exclusive of what may have been done by railway companies or other firms.

I have taken, for this meeting, a series of tests of the illuminating power of coal gas compressed to various pressures, the results of which are shown on the table appended.

I have not been able to do quite as much as I wished in this direction, but as much as the time I had available would allow; and as the question of illuminating power in relation to storage capacity is of such importance in train and tramway lighting, also for buoys and beacon lights, I have shown these results for the information of the members.

APPENDIX.

Statement of Tests of Compressed Coal Gas for Railway Train Lighting.

Date of Test.	When Gas was Compressed.	Pressures. To which Originally Compressed.	Pressures. In Cylinder at Time of Test.	Temperature of Gas.	Illuminating Power. Gas Uncompressed.	Illuminating Power. Gas Compressed.	Percentage Loss on Compression.
1892.	1892.	Lbs.	Lbs.	Deg. F.	Candles.	Candles.	
Mar. 16.	Mar. 14.	150	132	69	14.17	9.50	32.9
"	"	150	130	69	14.17	9.00	36.4
"	"	150	128	69	14.17	8.26	41.7
Mar. 18.	Mar. 14.	150	100	72	14.17	11.49	18.9
"	"	150	75	72	14.17	10.67	24.7
"	"	150	50	73	14.17	10.42	26.4
Mar. 21.	Mar. 14.	150	25	60	14.17	10.96	22.6
"	"	150	15	61	14.17	10.44	26.3
"	"	150	5	61	14 17	11.75	17.0
April 5.	April 5.	20	20	66	15.83	15.77	0.37
" 7.	" 7.	20	50	67	15.50	15.04	2.9
" 8.	" 8.	100	100	62	15.50	12.79	17.4
" 8.	" 8.	150	150	65	15.50	10.86	29.9

Remarks.—In the tests made during March the gas was compressed through the catch-box into a 10 cubic feet cylinder to 150 lbs., and the pressure was afterwards relieved. In the April tests the gas was compressed direct into 10 cubic feet cylinders without passing through the catch-box.

Tests of Oil Gas Burners for Railway Train Lighting.

Description of Lamp.	Gas Consumed per Hour.	Illuminating Power. Total Per Lamp.	Per Cubic Foot.	Per Burner Per Foot.	Per Burner.
	Cubic Feet.	Candles.	Candles.	Candles.	Candles.
Triple burner.....	1½	8.67	5.78	1.93	2.89
"	2	11.18	5.59	1.86	3.73
"	2½	19.52	7.80	2.60	6.51
Duplex burner.....	1	8.20	8.20	4.10	4.10
"	1½	13.25	8.84	4.42	6.62
"	2	17.08	8.54	4.27	8.54
Single burner.....	½	3.70	7.40	7.40	3.70
"	¾	5.52	7.36	7.36	5.52
"	1	7.56	7.56	7.56	7.56

Western Pennsylvania Mining Institute.

We publish the following at the request of Mr. William Seddon, Secretary of the Institute :

From time to time there are rumors set afloat by certain mine officials not connected with this Institute, and who either have no intention of joining it, or are not eligible to membership on account of their general behavior and character ; I deem it my duty as Secretary of the organization to state that our motto is "*safety*, *economy* and *perseverance*."

It has always been the object of the members to first carefully consider *safety* as of the utmost importance in the working of the mines under their charge ; and *not* as some people would have the public believe, the discussion of means whereby we can secure an advance of salaries. In the discussion of the best possible means of securing safety we derive benefit because we are preparing ourselves to overcome difficulties whenever they present themselves, and the miners under our charge and our employers are both benefited either directly or indirectly in proportion to our attendance at the meetings of the Institute.

Some colliery officials do not consider it necessary to study or discuss methods of mining after they have secured a certificate of competency as a mine foreman, thinking that because they are competent as far as the present mine law is concerned, that is all that is required of them. This is not the true spirit. The Board of Examiners that granted them certificates did not imagine any such line of thought, or they would not have granted the certificates to candidates of such a frame of mind. In passing an examination, we do not get a diploma guaranteeing that we are absolutely capable of managing a mine safely and successfully, and there are none that more fully understand this than the members of this Institute. Their attendance at our meetings proves to me that they feel the necessity for more extended knowledge.

For the past five years we have been holding these meetings to advance ourselves in the theory and practice of mining and its allied sciences.

I think we have a great deal to learn before we can assume to be even comparatively safe in our mines. In the matter of gases met with in mines, our theoretical knowledge is obtained from text-books which are very good in their way, but our knowledge is not as complete as it can be made by conference with our fellow-officials on the practical experiences we have each had. I do not think we have, as yet, advanced far enough in our knowledge of gases to prevent serious disasters. It is only under certain conditions that we are capable of lessening fatal accidents in mines generating gas. It would appear that there is some gas present other than those we expect, or are taught to expect, and it is one with which we are not familiar, if the evidence offered from time to time after serious explosions is correct.

This evidence is to the effect that the mine was free of explosive gas shortly before the explosion. Admitting that a small percentage of gas and a highly volatile coal dust will cause an explosion, I still think it possible that we could have gases present for which we have never searched and of whose nature we are ignorant. It is possible that there is a gas given off that, owing to its affinity for the hydrogen present in firedamp, or the friction of its own atoms under certain conditions—such as a heavy blast, a blown-out shot, or a sudden fall of roof—will ignite with serious results. While we have gases taken from the mine and tested for their inflammable nature with certain quantities of air, we do not have them tested regarding their constituent parts, and these are important factors.

All explosions do not occur in a like manner. At the time of the recent explosion at McAlester, Indian Territory, the manager ordered the speed of the fan immediately increased. This appeared at the time to be the most essential thing to do, and it proved to be the correct thing to do. I have, however, known instances where a similar action proved disastrous both to the rescuing party and the mine. This goes to prove that all explosions do not occur in the same manner, neither do they end with the same results.

Much more evidence could be offered on this subject, but as time is so limited I intend to touch on only a few of the important difficulties with which we have to contend. In ventilation the notion that one mine is as easy to ventilate as another is absurd. Though located side by side difficulties will present themselves daily in one mine which in the other mine may never be met with. The superintendent of one may not be as willing as the superintendent of the other to have the mine in a well ventilated condition. He may refuse to erect a furnace or fan where such is required, or he may insist on a furnace where a mechanical ventilator would be better. Our formulæ to find quantity, size of air-ways, power, etc., cannot be called, at all times, correct. While these formulæ may be useful, and may show the intelligence of the mining boss who is able to work them, it is only possible to arrive at approximate results by their use. I do not want to appear as condemning the works of Atkinson, Fairley, or Wilson. They are useful and have done a great deal of good, and will, I hope, continue to do so. They are undoubtedly right, if the air-ways and entries are driven as true and smooth as the entries on which these formulæ and co-efficients were based. This being the case, there is room for further study and advancement on our parts. We should arrive at some system whereby we can come nearer to what we want in calculating lengths, size, quantities, power, etc., in our crooked and usually jagged air-ways that we have in our mines at the present time.

Drainage is another important study, both theoretically and practically, for good drainage is essential for health and safety in mines. I do not hesitate to say that a few lessons in this branch would do none of us any harm.

Timbering is a subject that I think has been neglected. We do not see many mines that can be truthfully said to be well timbered. In our River mines we stick to the old system of cross bar and post, no matter what the nature of the roof or floor may be. On the continent of Europe they have an entirely different system. I have heard professional men, who visited the mines, say that they work seams by using their method of timbering, that could not be worked at all if timbered by our method. There is no doubt, but that there is plenty of room for improvement in our manner of timbering.

Haulage is another subject that demands an important share of our attention. While we have in this vicinity some fair systems of haulage, we could improve them considerably if we visited mines where the most improved systems are in use, and discuss our experiences and the ideas gained at these meetings. Economy is one of the main requisites of successful mine management, and both operator and miner benefit by it. The one directly the other indirectly. I do not mean by economy,

reductions of wages to make up deficiencies due to mismanagement. I mean economy in the use of men and material. The mine boss should look on all expenses as if they were to be paid out of his own pocket. A waste of material is no credit to an official, but on the contrary, it is injurious to his character, as well as a loss to his employer.

Where is there a better place to discuss economical methods of mining, than among the practical men composing the membership of this Institute?

The third point in our motto is "Perseverance." This is essential if a man wants to be successful in any avocation, but in none more essential than in the avocation of a mine foreman. No doubt it is disheartening to find yourself pressed on every side with difficulties over which you have no control. Your mine may not be in the shape you would wish it; you may be troubled with an excessive amount of water; your air ways may need timbering or retimbering, and you cannot find time to attend to them or even give instructions as to the way you want the evils overcome, because your time is all taken up by other equally important work. More coal is needed than you can produce, owing to your entries striking the dip, and you have not the means to get the water out of them, or the entries have struck a rise and gas has begun to appear, and your ventilating power is insufficient. All this may happen, and considerably more. Under such circumstances the best of our mine foremen will at first become disheartened. But by carefully considering the situation, and with intelligent work and perseverance, they will overcome the difficulties, and will have the mine in a fair, if not in a good condition, when the mine inspector pays him his next visit.

If I were asked the question where could a man get better advice, if placed in the position I have described, than by attending the meetings of this Institute, I would be at a loss for an answer.

In conclusion I would say there is a large field of knowledge in which we have never entered, and which we are not even acquainted with, that can be cultivated by attending our meetings, so as to bring forth fruit "an hundred fold." As we have done during the past five years, let us continue practicing our motto, and show by our actions and the transactions of our Institute that our meetings are not to discuss the wage question, but to cultivate the acquaintance of each other and discuss the true theory and practice of mining with credit to ourselves, profit to our employers, and a deep regard for the welfare of the men under our charge.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, April 15, 1892.

Personal.—Comparative Cost of Oil, Gas and Electricity.—The Gas Stove Season.—The Residual Market.—A Visit to the Severn Tunnel.

My first duty this month is to endeavor to give some expression to the sincere regret with which the intelligence of the death of Mr. G. Shepard Page has been received amongst English gas engineers, who find it hard to believe that their meetings are no more to be enlivened by his genial presence. It has come as a surprise, for the energy exhibited by Mr. Page on the occasions of his frequent visits to this country led us to believe that there was every prospect of his active and usual business life being continued for many years to come. Those who were present at the meeting of the Gas Institute, held in 1888, and heard our deceased friend read an address from the Western Association of the United States, which he had been deputed to deliver, and also his reply to the international congratulations, which were addressed to a contingent from France, and to himself as representing America, by Mr. Denny Lane, of Cork, on behalf of the Gas Institute, will ever hold his memory dear. And I am sure it is the wish of many in England, as well as myself, to express to the relations of the deceased gentleman a feeling of sincere sympathy and condolence with them in their heavy trial, and an assurance of the high esteem and respect in which his name will ever be held in England.

Some figures showing the comparative cost of gas, oil and electricity have recently been published in a magazine and may be regarded as coming from an independent source. Of course they refer only to London and to the present time. The standard taken is a light of 48-candle power maintained for 2,000 hours, that period of time being taken as representing a year's requirement of artificial light. The cost of repairs and renewals is included in each case, and the gas is taken at 3s. per 1,000 cubic feet, the petroleum at 7d per gallon, and the electric light at 8d per unit. The results are based upon careful experiments under ordinary household conditions. As regards gas, it will be seen how important a factor the burner is in making up the cost—a fact that gas consumers are very slow to appreciate. With Argand burners the cost of gas is 93s.; with Albo-carbon, 55s.; with Wenham lamps, 41s., and with the Welsbach incandescent system, 30s. The only one of these figures to which any demur might be made is that for the Welsbach system. To produce the amount of light above named three 16-candle burners would be necessary, and each of these are usually supposed to use 2½ cubic feet of gas per hour. This gives 45s. for gas alone, and after paying for the gas there is the renewal of mantles to provide for, so in this case the figures are obviously wrong. Petroleum used in small lamps would cost 58s., but with the Vulcan lamp 44s, showing that in the case of petroleum also the appliance used has a very important effect upon the cost. The cost of electric lighting by incandescent lamps is 245s., a figure that approaches closely to the generally accepted estimate that each penny per Board of Trade unit is equal to one shilling per 1,000 cubic feet and, therefore, that at 8d per unit the cost is equivalent to that of gas at 8s. per 1,000. And yet there are some who profess, by accurate scientific experiments, to show that the cost of electricity is about the same as that of gas.

What is now becoming known as the "gas exhibition season" has begun, and the agents for manufacturers of these appliances are on the war path, seeking with honeyed accents to pound into gas managers heads the idea that "an exhibition in your district" would be a great advantage. This field appears to be sufficiently attractive to draw others into it, for scarcely a year passes without some addition to the already long list of gas stove manufacturers. Only last year a new firm gathered a good harvest from the neglected gleanings left by older establishments, by going around to small villages of only 1,000 or so population, that had been supposed to be too insignificant to afford opportunity for business. A week or so back, I visited an exhibition promoted by a well known firm, at which the attractions of gas appliances were enhanced by piano-forte solos at intervals, and which also included exhibits of patent foods and household requisites generally. So far as could be judged, the affair was a success. There was a large audience of ladies, listening to the silver tongued eloquence of the lecturers, and as soon as the cookery demonstration was over, the commencement of a really first class performance on the piano induced many to stay and look at the exhibits, who would otherwise have rushed out, without noticing anything, as soon as the lecturing was concluded. These gentlemen teach gas companies a lesson that many of them stand in need of, and that is the importance of establishing a good understanding with the consumers. To this end one must go further than the blind following of some prevalent customs that had answered well in other towns. A course of action that may just do for the requirements in one town may not be suitable for another, as a great deal depends upon the habits of the people and the business customs prevalent in the district. Those who have been most successful in pushing the sale of gas in this country, have not been blind followers of set customs, but rather have seen where the opportunity for gaining business was to be found, and have laid themselves out to meet it. As an example of what I have been attempting in this way, I enclose with this a copy of a circular that is now being issued to the gas consumers in Salisbury, and perhaps a spare corner may be found for it in the JOURNAL.

Although the demand for gas increases, things are at present very quiet in the residual market. More gas means more coal carbonized and more coke left on hand to sell. This fact, taken together with the introduction of generator furnaces, enables us to understand that the quantity of coke left for sale in gas works must have largely increased within the last few years. This spring there has been 1 or 2 spells of mild weather which of course diminishes the consumption. Several other reasons have contributed to make the coke hang on hand, and the result is that most of the larger gas companies are complaining of reduced returns for coke. When this state of thing occurs, the smaller undertakings are forced to follow suit. For the larger companies advertise in all the papers and send out agents within a radius of 50 or even of 100 miles, with a view of reducing the accumulations in their coke yards, frequently resorting to the plan of offering it at a low rate. Consequently the small company must either sell at the same rate or else lose its customers. In my own neighborhood the price obtainable for coke is practically controlled by the proceedings of a large company 60 miles away. Unfortunately this fall in the value of coke has been attended by a large decrease in the price obtainable for tar, while sulphate of ammonia remains at the same low figure that has prevailed for some time. The price of coal is very high and likely to continue so, while the quality sent out is not equal to that we have hitherto been able to obtain. So that the question of developing a local demand for

residuals is likely to come forward this summer. When good prices could be obtained for coke, the tar was worth 20s. to 30s. per ton for use as a fuel under the retorts. But it is not worth while to increase the already large stock of coke by this means under present circumstances. So there is room for some new suggestions for accelerating the disposal of coke, tar and ammonia.

The coke trade in this country has always been of an erratic character. Sometimes all the yards are empty, and customers must be refused, whilst at others the opposite extreme is reached, and some have to hire additional land on which to store their surplus. And this without any substantial reason being discernible The present low prices will no doubt direct attention to the subject of water gas as one way of reducing the coke heap, especially as oils are cheap and cannel is dear.

The members of the Southwest of England District Association of Gas Managers had a pleasant and useful change from the usual routine of their meetings, this spring, in the shape of a paper read by Mr. Chas. Richardson, M.I.C.E., giving a description of the Severn Tunnel, including some of the difficulties encountered during its construction. On the following day a large party visited the tunnel. As Mr. Richardson was not only the originator, but also one of the engineers concerned in the carrying out of the Severn Tunnel, it may be imagined that he would find much of interest to talk about. He commanded the steady attention of the meeting for an hour and a half, with his vivid descriptions of details concerning this important work, interspersed with useful hints for engineers. This tunnel forms a connection or "short cut" between the coast of South Wales and that of the West of England. It is four miles and a quarter long, exclusive of approaches, and passes beneath the Bristol Channel near the mouth of the Severn, at a point where the water is two miles across at high, though only half a mile at low tide. The great difficulty which has made this large structure famous in English engineering history has been the large body of water encountered, which more than once flooded the works and stopped progress. This has necessitated the erection of permanent pumping stations in connection with the tunnel, and in the wet season as much as 30½ million gallons of water is removed. The pumping stations are therefore equal to the supply of a town of 1 million inhabitants with water. There are three pumping stations, one near each end of the tunnel, to intercept as much as possible of the drainage and surface water before it reaches the lowest level, and a third as near as possible to the middle, close to the water side. Here there is a large ventilating shaft, having a fan 40 feet in diameter by 12 feet wide at the top, and capable of withdrawing 250,000 cubic feet of air per minute, for ventilating the tunnel. This arrangement is most effective, as the air even in the center part of the tunnel is perfectly pure and cool, and every vestige of the smoke from a passing train is drawn off in a few minutes. Those of the party who were adventurous enough to care for the descent were taken down one of the pumping shafts, and allowed to explore the tunnel, and also to visit some of the adits that intercept the principal springs. Mr. Richardson is now 78 years of age, and has retired from business life, though still enjoying a fair measure of health and activity. The tunnel has occupied 25 years from the time of its projection, until it was finally completed about 6 years ago. A large traffic, both goods and passengers, is conveyed through it, and it saves a ferry passage, or the alternative of a circuitous route of some 50 miles, up to the first bridge over the Severn.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Derby Gas Company, of Birmingham, Conn., the following Directors were chosen: William B. Wooster, Charles Nettleton, William E. Downes, Royal M. Bassett, Thomas Wallace, Frank E. Hoadley, Chas. E. Clark, Charles E. Bristol and Charles H. Nettleton.

The annual meeting of the engineering staff of the United Gas Improvement Company was held in Philadelphia, on the 20th, 21st and 22d of April. About 45 delegates were in attendance, and the proceedings were under the direction of Mr. A. C. Humphreys. A large part of the sessions was devoted to a discussion of the best means for increasing the use of gas for purposes other than lighting, and some novel plans for accomplishing the end in view were presented. The meeting was a very successful one.

Writing of the use of gas for purposes other than lighting, and the best means of spreading this light to present and prospective consumers of gas, puts us in mind of the fact that our English correspondent, Mr. Norton H. Humphrys, whose newsy article in our columns has been a prolific source of interest to our readers, has had much success in extending the sale of day gas in the pretty city of Salisbury, that is famous for its running brooks and its Thirteenth Century Cathedral. Mr. Humphrys, who is the capable Manager of the Salisbury Gas and Coke Company, keeps nagging at the residents—perhaps "hinting" would be a more appropriate word than "nagging"—in a pleasantly insistent way by reminding them how gas can be used in the household other than through the ordinary gas burner, and does not fail to keep in full view the very important adjuncts that such differing uses are obtained at no loss in the items of cost and duty. The last "hint" to the good folk of Salisbury given by Mr. Humphrys was in the shape of a handsomely printed circular, the lines of which are as follows: "*Salisbury Gas and Coke Company.—Gas for heating and cooking purposes.*—For many years, even when the price of gas was higher than it is now, the number of all classes of gas cooking ranges and stoves in use throughout the country has gradually increased. Some 500 are in use in Salisbury, in hotels, restaurants, places of business and private houses. Gas offers great advantages, as a fuel, for all kinds of cooking, such as roasting, boiling, steaming, grilling, frying, etc. The consumption of gas begins only when the cooking is commenced, and ends directly it ceases. The cooking is done to perfection, as the power of the range is controlled by a single tap, and the gas is always ready at a moment's notice, day or night. For cleanliness this mode of cooking cannot be surpassed, and the loss in weight of meat is considerably less than when cooked by a coal fire. The Salisbury Gas Company were amongst the first to offer their customers the advantages of gas stoves on hire. For the last 30 years they have supplied them at a rental of 2 shillings per quarter, upwards, according to size, and, as the result of experience gained during that period, they are able to send out stoves that will be sure to give satisfaction if used with reasonable care. If not more than 40 feet of pipe is required the stoves are fixed free of cost. The Company also let on hire an approved make of high power gas lamps. Over 100 of these are now in use in the city. Stoves or lamps may be seen and full particulars obtained at the gas works, Devizes Road, and orders, etc., by post receive prompt attention."

In the meantime it is well to remember, in considering the results gained in this direction at Salisbury, where over 500 stoves and upwards 100 high power lamps are in regular use, that the city cannot have a greater number of residents than 13,500, and that it is entirely devoid of anything that might be termed manufacturing—that is, it has neither mills, foundries nor factories.

At the annual meeting of the Hempstead (L. I.) Gas Light Company the following officers were chosen: President, Richard Ingraham; Vice-President, John Nix; Secretary and Treasurer, P. J. A. Harper; Superintendent, Stephen Powell; Directors, T. A. Carman, H. P. Seabury, J. B. Hall, Christopher Snedeker, P. J. A. Harper, R. Ingraham, John E. Davidson, Stephen Powell and John Nix.

The Manager of a progressive and wide awake Gas Company in this State, writing to the Journal under date of April 25th, says: "Your correspondent, over signature '14 Years a Gas Inspector,' has covered the ground thoroughly in his reply to the suggestions advanced at the recent meeting of the Ohio Gas Light Association on the subject matter of the paper entitled 'The Prevention of Errors in Reading Meters.' I would like to add a word or two on these things. The meter—a silent but just monitor—is probably one of the most abused pieces of machinery invented by man. A gas engineer of long experience remarked in our office a few days ago that a Chinese puzzle was a wonder and a puzzler to mankind, but from his observation he thought that a lare majority of gas consumers held that a gas meter was of a type with the aforementioned class of puzzle. This same engineer also put it forward as his belief that often the road to heaven emerged from a gas office—at least that any one who superintended or managed a gas industry and came out clean and undefiled would certainly be entitled to a visa that ought to pass him in safety to the land of eternal rest. In respect to some of the Ohio remarks, in my belief a man who cannot be trusted with the route book is not a person qualified to read the meter at all. I would suggest, as a reason for causing the meters to be placed in desirable and convenient locations, that the meter manufacturers ornament the cases with a landscape view or something of that sort which would cause the meter to be looked upon with favor, even in a parlor. The trouble is, as we all know, that dark holes and dingy corners are the sites usually selected. We place a card carrying a picture of the dials of a meter, with clear instructions for the purpose of enabling the consumer to read the same, in the hands of our customers; and not only so, but, whenever it is possible, we see to it that some member of the

household is present when the meter statement is being taken. By dealing with our customers on strict business principals we command their respect and increase our trade.

"I also read with interest the article by Mr. Truesdell (p. 601 of last issue) entitled: 'Coal Gas versus Electricity—What do We Pay? and What do We Get for Our Money?' These interesting statistical facts, coming from the source they do, should cheer and encourage the gas men, who have now become hardened to the knowledge that the electricians win from them many a customer by promising them more light for less money, adding thereto the other gratuitions, and equally false assertion that the days of gas as a lighting agent are numbered. Statistics of the Truesdell sort are well worth wide circulation. I notice your list of subscribers to the proposed gas building at the World's Fair, and our Company will contribute its mite."

MAYOR STUART in his annual message to the Philadelphia Council makes the statement in support of the desirability of the city's operating an arc electric lighting plant on municipal account: "The expense of the Bureau of Lighting must necessarily increase each year upon the annual extension of public lighting. The number of electric arc lights in 1890 was 1,293, and in 1891 was 1,719—an increase of 426 over 1890. The number of gasoline lamps in 1890 was 7,160 and in 1891, 7,911—an increase of 751. The total number of electric, gas and gasoline lamps now in charge of the Bureau of Lighting in 1890 was 28,013, as against 30,141 in 1891, an increase of 2,128. This statement presents additional support to my argument recommending that the city, at the earliest possible opportunity, erect and control her own electric light plant for municipal purposes. Each additional arc light upon the public highway is not only a convenience to the citizens generally, but is also of material aid in the prevention of crime."

THE annual meeting of the shareholders in the Bridgeport (Conn.) Gas Light Company was held recently and the following officers were chosen: President, W. R. Higby; Secretary and Treasurer, F. B. Sammis; Superintendent, C. A. Gerdenier; Directors, W. R. Higby, S. C. Trubee, H. L. Clark, Horace Nichols, W. H. Perry, W. D. Bishop, W. B. Hincks, E. G. Burnham, and A. J. Hobbs. The new name on the list is that of Mr. A. J. Hobbs, who succeeds his father, the late A. C. Hobbs.

WE are indebted to an occasional correspondent for a copy of the Utica (N. Y.) *Observer*, which contains the following account of a "starter" that was made to popularize the use of gas in that city for cooking, etc., by the proprietors of the Equitable Gas and Electric Light Company. "A few invited guests enjoyed a treat at No. 16 Taylor avenue, the pleasant residence of E. A. Pinkney, Superintendent of the Equitable Gas and Electric Company, last evening (April 18), in the shape of a sumptuous dinner cooked entirely with gas as fuel. Included in the party were four local newspaper men, Mr. Pinkney's object in extending the invitation being twofold—sociability, and to afford a practical demonstration of what can be done with gas in the line of cooking with the latest improved facilities for its use for that purpose. Three courses were served. These included soup, beefsteak, turkey, hot muffins, macaroni, bread, cake, etc., with everything done to a turn—in fact, more thoroughly and evenly cooked than is generally the case where the coal range is used. The subject of gas as fuel was discussed along with the good things on the table, and it was learned that the steak, which was an inch or over thick, was cooked exactly in 12 minutes; the turkey, weighing 10 pounds, in 2 hours, or 12 minutes to the pound; and the muffins both made and baked in 22 minutes. The usual time given turkey in the ordinary stove, by the way, is from 15 to 18 minutes to the pound. It was observed also by all present that that both the steak and the turkey retained their juices to a remarkable degree. Even the white meat of the latter, usually so dry, was moist with its own palatable flavoring and exceedingly tender as well. And certainly no jucier or more savory steak could be desired by the most fastidious epicure. In explanation Mr. Pinkney showed statistics compiled from actual tests made, which prove that the loss in food cooked by gas is in the ratio of 17 to 32, when cooked with coal, or 48 per cent. in favor of gas. Further in explanation, Mr. Pinkney said that it required only about 10 minutes to heat the oven ready for use. Then it can be easily kept at exactly the same temperature, or more or less as desired, and in this way the meat or other article in the oven is evenly as well as quickly cooked. By the gas system a 30-gallon tank of water may be heated for bath purposes at a cost of about 5 cents. Mr. Pinkney also heats by gas the water used at his house for washing clothes, as was seen at his residence to-day. When asked about the comparative expense in the use of gas and coal for heating, Mr. Pinkney replied that the relative cost of gas as against coal, if economically managed, is about the same, saying nothing about the convenience, cleanliness and comfort, doing away with the heat, dirt, ashes and lugging inseparable from the use of coal. The cost of gas stoves ranges from $1, for the ordinary single burner, to $35 for the fully equipped 6-burner range with ovens and water back. Among the guests present last evening was Dr. A. Ritter, a next-door neighbor of Mr. Pinkney, who is an enthusiast on the subject of gas as fuel, made so by experience in its use in his own home for the past year or more. The Equitable Gas and Electric Company has opened a store on the corner of Fayette and Washington streets for the sale of gas stoves, heaters and appliances of all kinds and of the latest improved makes. The present efficiency in the use of gas as fuel is due in a large degree to late improvements in the construction of the fixtures, greatly reducing the cost of operation. The Company makes no profit on the stoves, but sells them at actual cost price, the object being at present solely to introduce the stoves into use, so as to increase the consumption of gas by the community during the summer months. There is a great deal more of interest that might be said on the subject of gas as fuel, but it can be better understood by calling at the store, examining the stoves and having the matter fully explained with a stove in operation. The actual cost of operation can be demonstrated on the spot. One of the ranges has been furnished the ladies at the Easter Market by the Company, where it may be seen in operation. That gas is coming rapidly to the front as fuel for cooking in summer is a certainty, and with the improvements constantly being made in heating appliances the Company is confident that it is only a question of time when it will largely supersede the use of coal in both cooking and heating."

THE shopkeepers at Rutherford, N. J., are very much dissatisfied with the service rendered them by the local electric light suppliers. In fact several of them have installed oil lamps, and are patiently waiting for the completion of the gas plant that is being erected by Mr. Van Steenbergh and his associates, who propose to supply gas not only in Rutherford but in the adjoining town of Boiling Springs as well.

THE Clark Brothers Lamp, Brass and Copper Company, of Trenton, N. J., have added a gas plant to their extensive works and are now using successfully gas for firing decorated glasswork in their new continuous kiln. They assert that it is a decided advance over the old plan of firing with coal, in that it is more economical and gives a finer finish to the goods. After an examination of the process the Trenton Lamp Company decided to put up a similar kiln.

IT is reported that a gas works will be constructed at Horton, Kansas. This place is on the Atchison, Topeka and Santa Fe Railroad at a point about 6 miles northeast of Emporia.

THE Newport (R. I.) Gas Company will make improvements on its office buildings.

FRED. BASCHANG recently filed a suit in the Chancery Court through which he seeks to enjoin the Newport (Ky.) Light Company from cutting off the supply of gas at his place of business, No. 921 Monmouth street. Baschang alleges that because he contracted with the Electric Lighting Company for a supply of incandescent electric lights, he thereby reduced his consumption of gas, but that he "still uses gas as far as is necessary." He does not want the meter removed. The Court granted a temporary injunction, and argument on a motion to make the injunction permanent will cause a trial of the merits of the case.

THE Derby Gas Company, of Birmingham, Conn., is extending its mains from Ridge street through Howard avenue.

THE Litchfield Shuttle Company, of Southbridge, Mass., is heating its forges by means of gasoline gas.

SUPT. SCOTT, of the Lewiston (Me.) Gas Company, has been the recipient of many congratulations over the workmanlike manner in which the gas fixtures in the handsome new city hall building were installed. There are 576 burners in the building.

THE Oakland (Cal.) Gas Light and Heat Company have offered to buy from the authorities of Alameda the electric lighting plant that has been operated there on public account for some time. It is not at all improbable that the offer will be accepted.

SOME days ago the Lebanon (Ky.) Gas Company's plant was damaged by fire. Loss, about $2,000. Partly insured.

THE proprietors of the Stockton (Cal.) Gas Light and Heat Company have contracted with the Risdon Works, of San Francisco, for 3 compound tandem engines, of 200-horse power each, for the purpose of maintaining the increased number of arc lights asked for by the city. A portion of the power, however, is to be devoted to the needs of a new electric street railway.

A CHATTY account of the recent trip of the Gas Club of Chicago to Joliet has been forwarded us by "one who was there." Our correspondent writes: "The JOURNAL knows that The Club was to have visited Joliet on the 14th inst., for the purpose of making, among other things, a *not permanent* stay in the State Penitentiary; and the object of my letter is to tell you that the visit was made and that everyone was allowed to depart from the gaoler's care—and such a gaoler! April 14th was ushered in with a most depressing state of the weather. For the prior 3 months Chicago had experienced nothing like the weather specimen of that morning—a driving storm of rain and sleet greeted the faithful and fearless 35 who gathered in the Union Depot at 9 A.M. Once inside the handsome special car, all dullness vanished—chiefly in smoke and other 'things.' A quick run was made, which terminated in the cry of 'All out for the penitentiary.' All got out, only to be seized in the hearty grasp of 'Jim.' Elwood, Vice President of the Club, and Secretary and Superintendent of the Joliet Gas Company. Even as we strode upon the platform the 'clouds were pushed, not shoved,' away, and thus were we greeted with the first evidence of Elwood's managerial abilities. He even seemed able to bring out the sun. President Strong, of the local Company, aided by Mr. Elwood's manly sons—two strong—assisted in receiving us and in 'doing the honors.' 'All in for the penitentiary' was the next general order, and many were the jokes that were bandied when the portals were closing on us. Fortunately, to date no secular newspaper has wind of the affair. The rules for visitors, including the admonition 'not to recognize one's friends,' were read. Under the very courteous conduct of Chief Warden Dement the prison was inspected from top to bottom. It was a wonderful sight—1,506 prisoners all at hard labor showed what *might* become of boodling franchise aldermen. Alas! that it does not always follow. Stone cutting, boot, chair and clothes making, seemed to be the chief occupations. At noon 800 men were watched as, within 7 minutes, they all got their dinner, and went to their cells to eat the same. The Gas Club then got ITS dinner served within the walls. A substantial repast, from oxtail soup to coffee, all served by convicts in their regulation dress. While waiting for the same some really excellent music was given by the convicts, and the gas men enjoyed 'chipping in' to the hat that was passed, in order that they might have some tobacco money. A feature of the dinner were printed menus and programmes that Elwood had prepared, and which quite 'caught' the Club. Every man enjoyed the inspection of the penitentiary. The sights were novel, instructive, broadening and saddening; and the vote of thanks to Warden Dement was a full one. The Club then proceeded to the Joliet branch of the Illinois Steel Company. Iron, from ore to the finished product, was seen as the Club walked its respective legs off. Blast furnaces, Bessemer converters, puddling furnaces and rolls, came in quick succession. The manufacture of angle irons and shapes was especially noted by the constructive gas men present, and a special feature was the continuous process for wire rod—a patent said to net $700 a day in royalties to the inventor. The Superintendents of the various departments conducted the Club through, and were courteous to a degree. The Club much appreciated their kind attention. The manufacture of barbed wire was next witnessed; and the Club was then whisked by special steam and electric cars to the gas works, where much fun was poked at Brother Shelton, who, in the call for the meeting, spoke of them as 'of not the least interest.' The plant comes close to being a model one, of its size. No extra polishing had been effected, nor did the works need it, for Mr. Elwood believes in elbow grease and paint always. Several runs of gas were made on the Springer cupola water gas plant, and the Club then adjourned to the electric cars for a special run around the town. The celebrated quarries were visited, likewise the new Masonic fraternity building and Club House—the pride of Joliet—in which Manager Elwood is no slight factor. At six the party returned to Chicago; but not, you may be sure, before tendering thanks to the host who had so excellently conducted the day's sightseeing. No time had lagged, no time was wasted. Every minute was provided for. Transportation, a hearty dinner and cigars *ad libitum*, together with the services and courtesies of Joliets leading men at the feet of the Gas Club—all through the planning of our host. The question asked, as we all departed, 'What's the matter with Elwood?' met with a united and stentorian response to the effect that, 'He's all right,' that fairly startled the natives. Altogether, the trip was a great success. The weather cleared by noon, and the bother on this account after all was slight. Had it been auspicious at the start full 50 men would have turned out. As it was, the 35 or 40 well maintained the name of the Gas Club of Chicago. Those who were disheartened by the weather simply and decidedly missed it."

Flared Coal Tar for Waterproofing.

According to the *Revue des Travaux Publics*, the use of coal tar as a means of rendering masonry impervious to water is much favored in France. There are two ways of preparing the tar for this use—boiling and flaring. The former method is suitable for surfaces intended to be exposed to the atmosphere, while the latter is appropriate for surfaces to be covered up by masonry, earth, etc. By adding to the coal tar a paste made by dissolving India rubber clippings in benzine, a coating may be obtained which is still more resistant, elastic, and durable. For roofs the heat-absorbing quality of these black varnishes may be overcome by dusting them with any permanent white earth before they are quite dry. For masonry to be covered up, the use of flared tar is highly recommended. This is prepared by boiling the tar in a caldron, and filling a bucket two-thirds full from it. The tar is then lighted at the surface and allowed to blaze for 15 or 20 minutes, being constantly stirred the while with an iron rod. When a drop from the blazing bucket upon cold stone has the consistency of thick soup, the flare is extinguished by covering down the bucket with an iron lid. The tar will then be reduced to one-third its original bulk, and it must be spread as rapidly as possible upon the work with a cod-tail brush of vegetable fiber—care being taken to dip often, so as to prevent its cooling and hardening prematurely. If the flaring process is prolonged beyond the proper moment the result is a brittle product like sealing wax. When the flare is stopped at the right time, the resultant tar adheres very firmly to any surface, and can be immediately covered up with earth. It has a skin both hard and tough, underneath which is a viscous layer about 1-25th of an inch thick, which preserves its integrity for any length of time.

The Electrical Production of Ozone.

Dr. O. Frolich, of Dresden, after mentioning various laboratory experiments for the purpose, describes the plant as manufactured by Messrs. Siemens and Halske for the production of ozone on a commercial scale. The apparatus in which the discharge takes place is built up of an inner metal tube, kept cool by water, and forming the inner coating; this is surrounded by a celluloid or ebonite tube, and through the annular space between these two a continuous flow of oxygen is kept up. The outer surface of the celluloid tube has a metallic sheath which acts as the outer covering, and between which and the inner metallic tube a constant silent discharge is kept up. Ten such tubes are fixed together in a frame and joined up in parallel, both electrically and with regard to gas and water supply. An open circuit transformer is used, excited by a set of accumulators which also drive a small motor, by the spindle of which a make-and-break in the primary circuit is worked. The rapidity of make-and-break should be high, say, 600 per second.

The sharper the variations in the secondary circuit the greater the production of ozone, and for a few tubes the interrupted direct current gives much sharper variations than an ordinary sine curve alternating one. When many tubes are used, however, their increased capacity affects the former and rounds its wave down to a considerable extent, while it does not appreciably affect the alternating current, which is, therefore, to be preferred when very many tubes are used. There appears to be a certain number of alternations which gives a maximum of ozone. The production also increases up to a certain point with the rate of the passage of gas through the tubes, but beyond this point increasing the gas has no effect.

The amount of energy expended in the actual formation of ozone is extremely small. It makes very little difference in the total work done if the space between the tubes be filled with gas, water or highly rarefied air. A 2-horse power apparatus produces about 2.4 milligrammes of ozone per second. It would greatly increase its usefulness if ozonized air could be compressed like oxygen, but this presents difficulties, as special pumps must be used. So far, the author has not got beyond nine atmospheres. Various uses of ozone are mentioned, such as disinfecting ships and buildings, destroying insects and sterilizing water, treating sewage, and also for brewing purposes.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR—Jos. R. Thomas, C.E.
ASST. EDITOR—T. J. Cunningham.
MANAGER—C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

MONDAY, MAY 2, 1892.

The Market for Gas Securities.

The market for city gas shares presented nothing of moment during the week, although nominal quotations for Consolidated were fully one-half point higher than those reported last Friday. To day (Friday) opening sales were made at 114¼, and 114½ was bid at noon. Mutual and Equitable hold the figures of a week ago, and Standard common was inquired after. We look for quite a move in this stock after the annual meeting. Brooklyn shares show no change of moment, nor does the situation over there seem to have altered greatly in any respect.

We note the following sales at auction: 25, Peoples, Brooklyn, at 89¾; 75, Equitable, Memphis, at 62; 100, Indianapolis gas, at 102⅞; 200, U. S. Equitable, at 45 to 45¼. Chicago gas is strong, at 78¼, and Consolidated, of Baltimore, holds well the recent advance. The telegraph to-day informs us of the death of Mr. L. R. Smoot, the Secretary of the last-named Company.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

MAY 2.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	114½	—
Central	500,000	50	87	—
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	145	150
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	135	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	40	45
Preferred	5,000,000	100	91	93
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	111	—
Citizens	1,200,000	20	104	104½
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	130	131
" Bonds	300,000		102	—
Peoples	1,000,000	10	90	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	101	—
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	139	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	123	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1s Series S.F. Trust	7,000,000	1000	88½	89
2d " " "	3,000,000	1000	76½	—
Bay State Gas Co.—				
Stock	5,000,000	50	55¼	56
Income Bonds	2,000,000	1000	76	80
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Company	25,000,000	100	78¼	—
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	77¼	77⅜
Equitable Gas & Fuel Co, Chicago, Bonds	2,000,000	1000	—	97½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	100	—
2d "	2,500,000	1000	96	—
Consumers Gas Light Co., Jersey City	2,000,000	100	15	20
Bonds	600,000	1000	72½	75
Cincinnati G. & C. Co.	7,000,000	100	—	200
Consumers Toronto	1,000,000	50	180	185
Central, S. F., Cal.			90	—
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	—	53⅜
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	180	200
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	19¼	20
Preferred "	2,500,000	100	57	58
Bonds	9,034,400	1000	82	82¼
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			34¾	35¼
Peoples, Jersey City		—	115	125
" " Bonds			—	—
Paterson, N. J		25	99	102
Rochester, N. Y		50	99	100
Syracuse, N. Y	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	63	63½
Washington, D. C.	2,000,000	20	200	208
Wilmington, Del.		50	88	90

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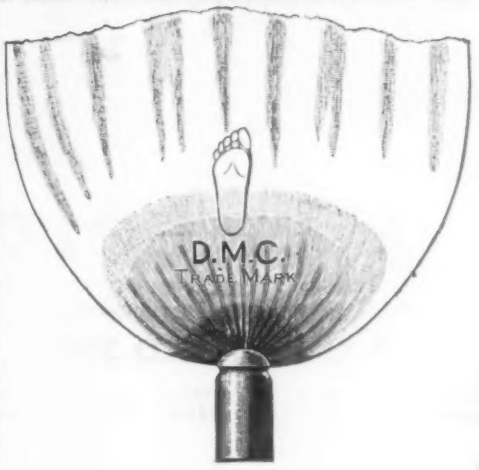

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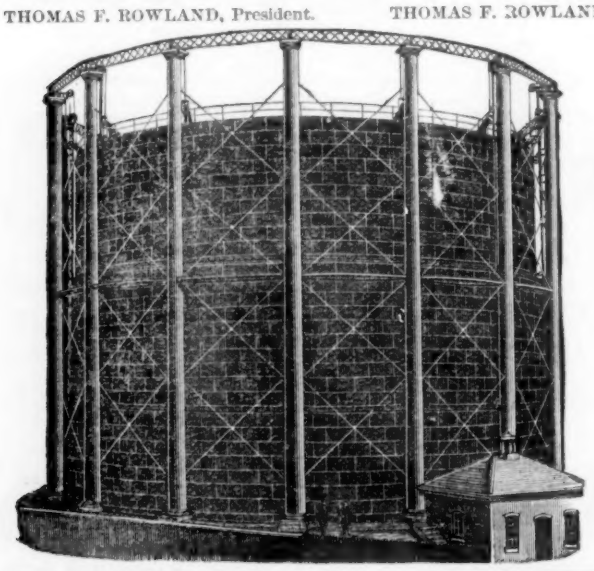

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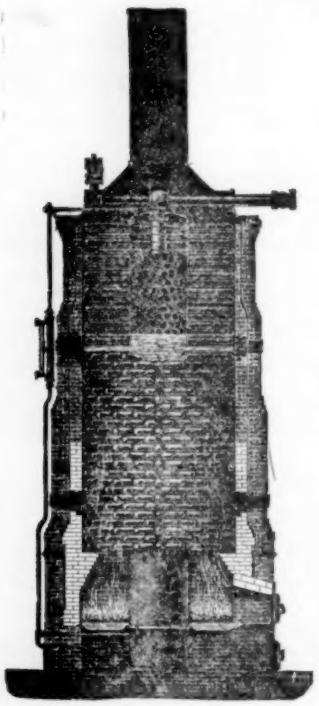

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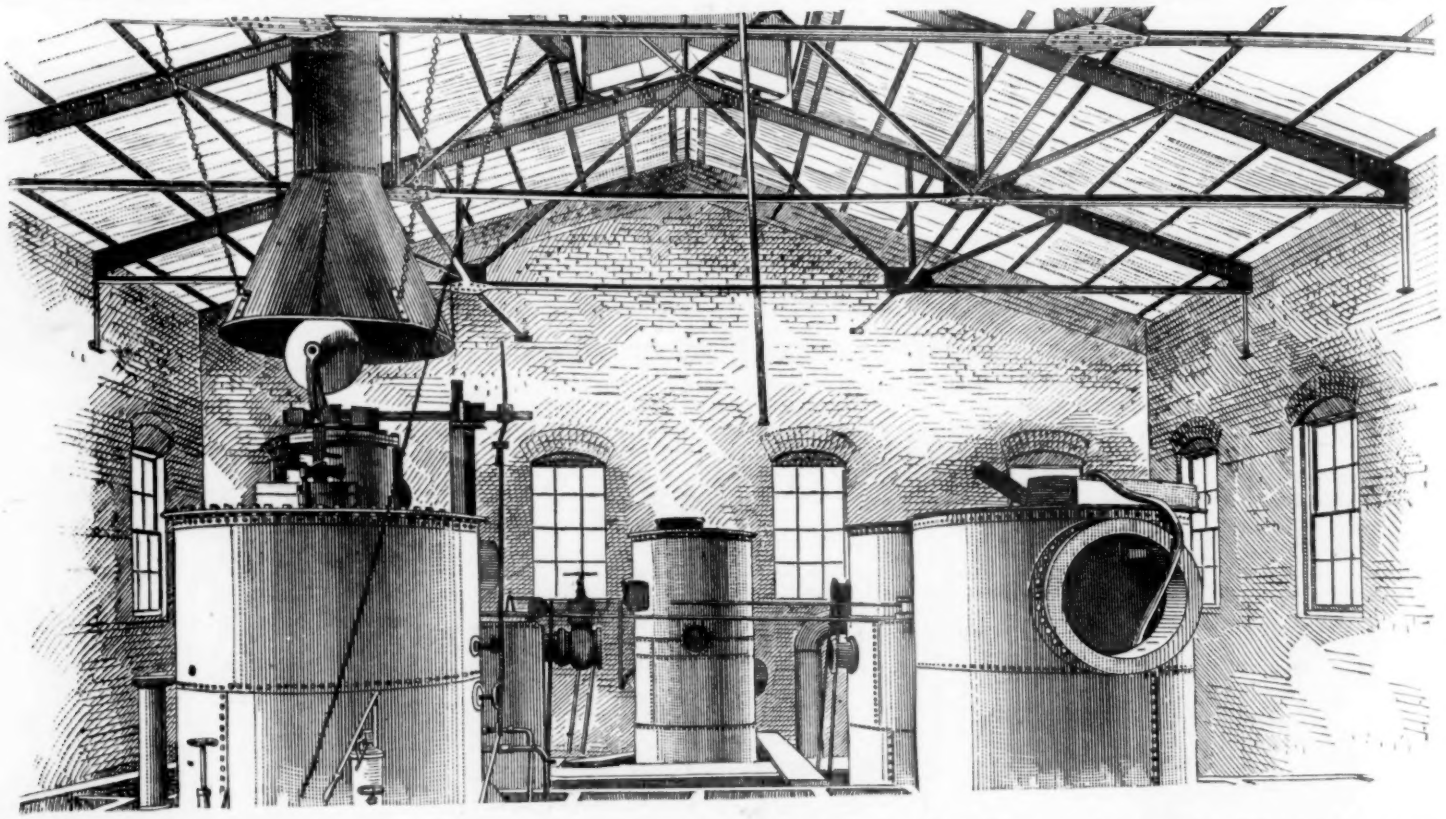

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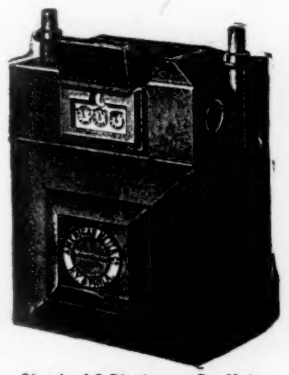

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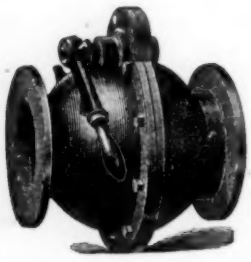

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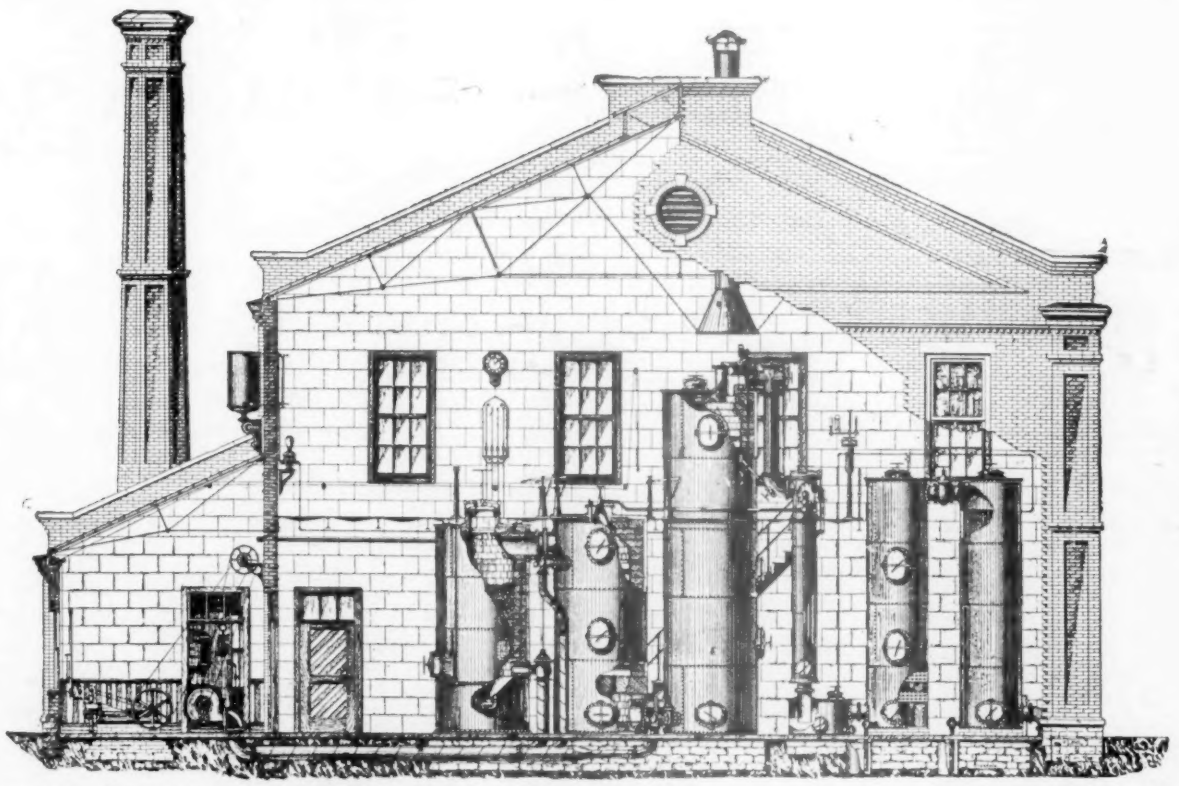

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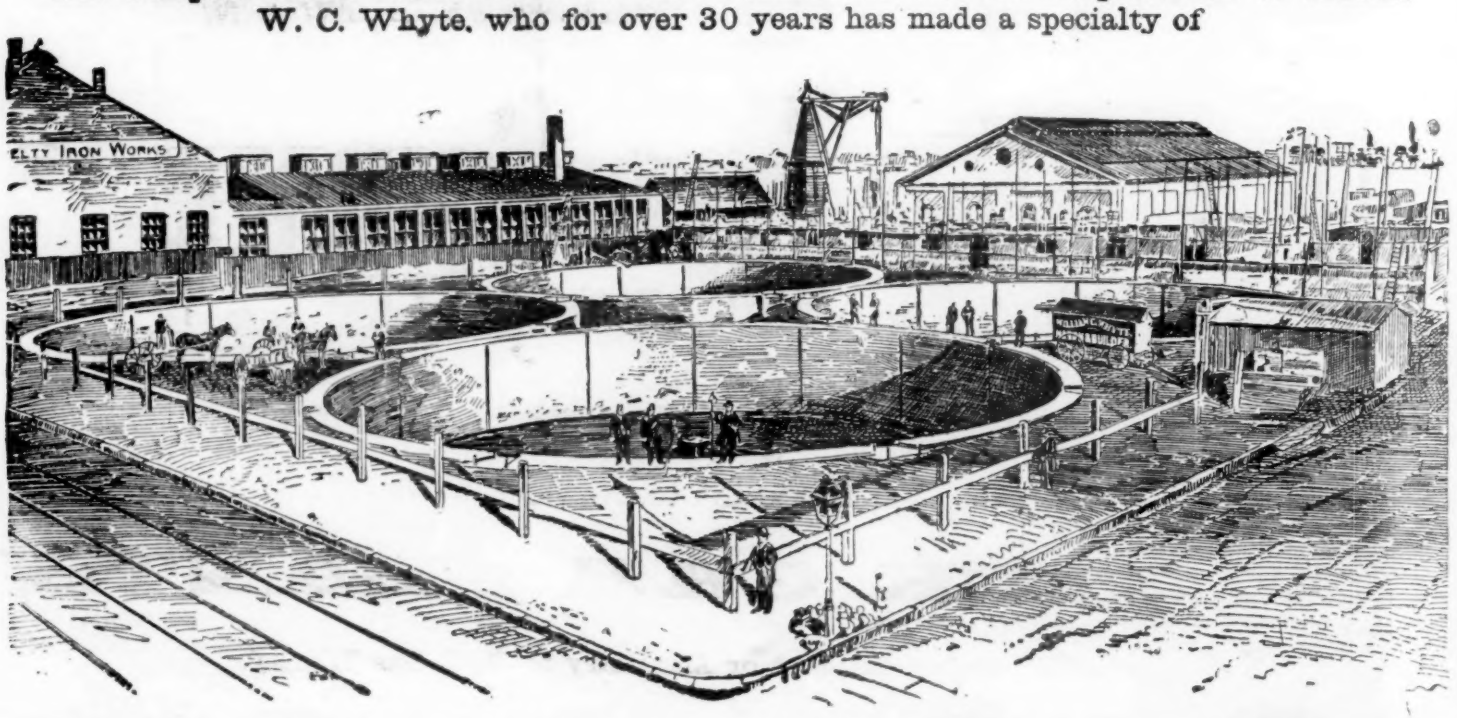

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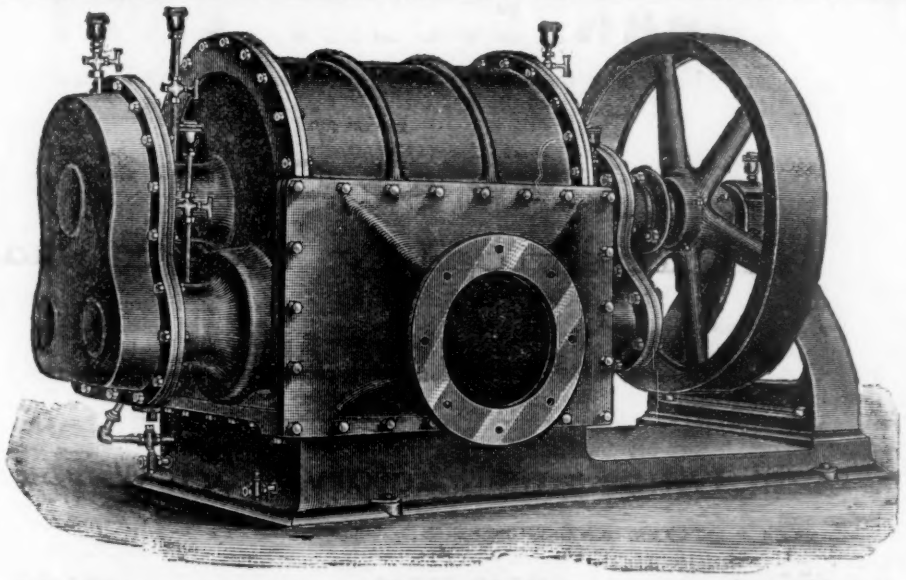

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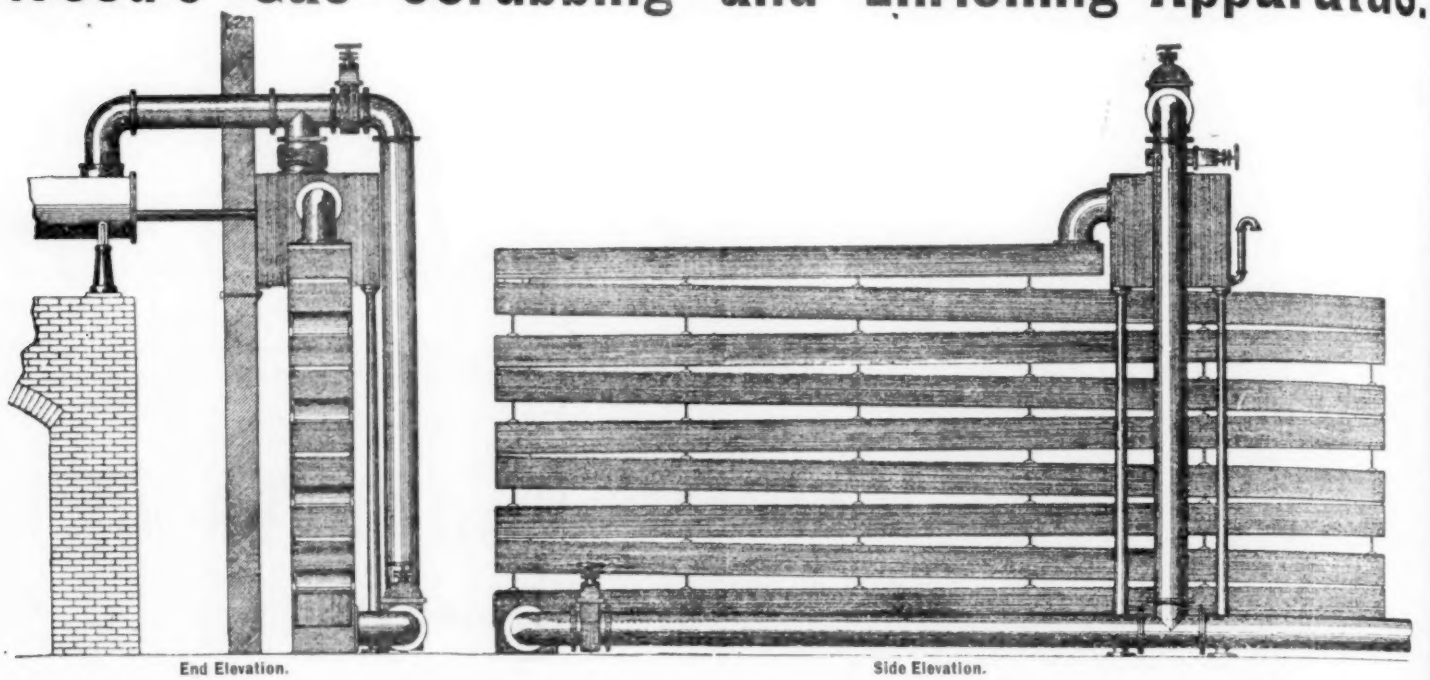

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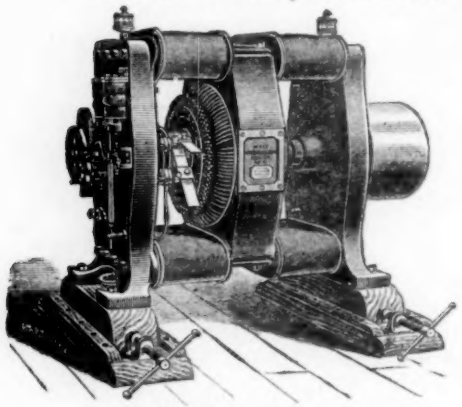

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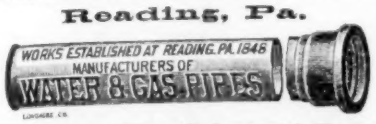

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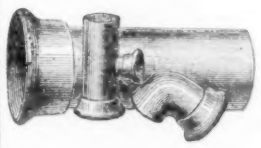

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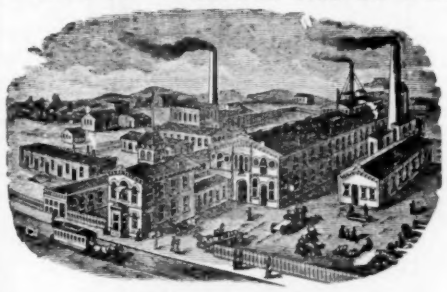

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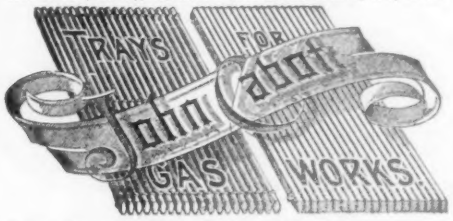

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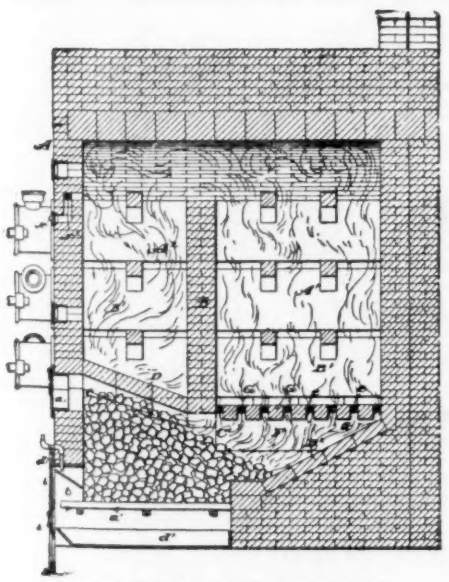

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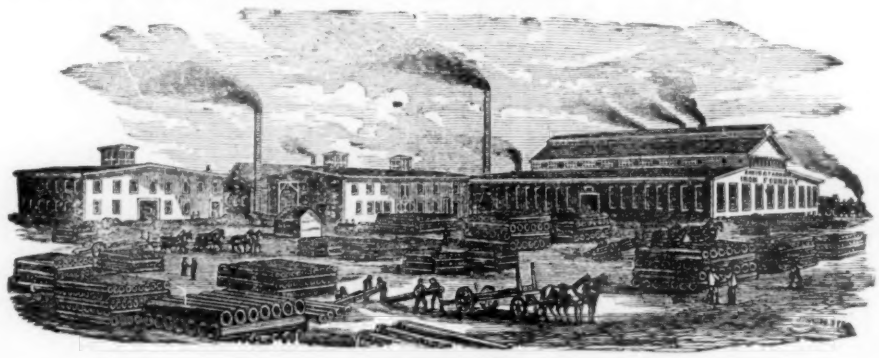

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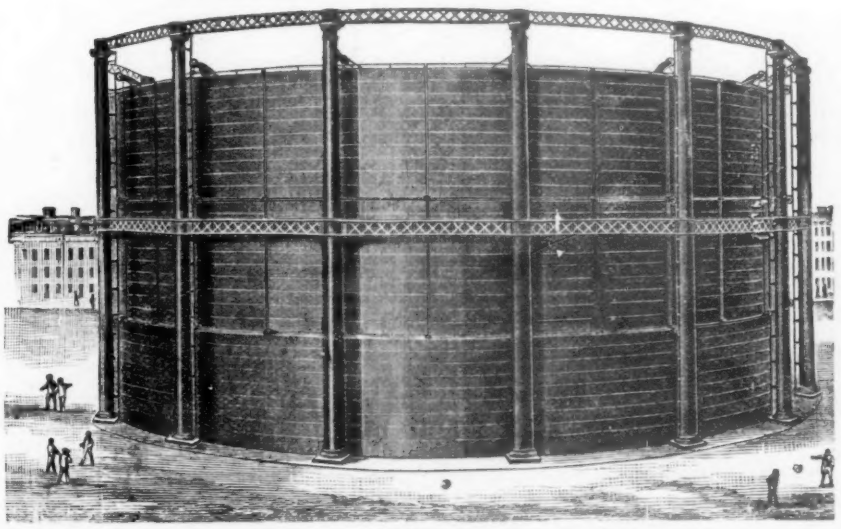

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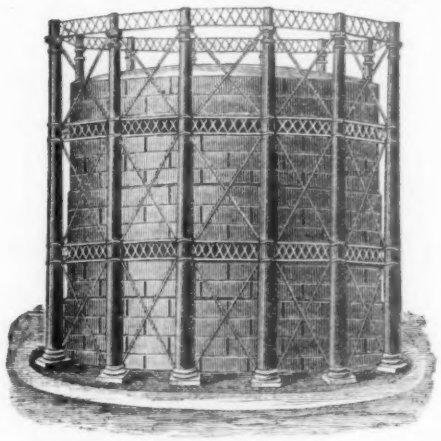

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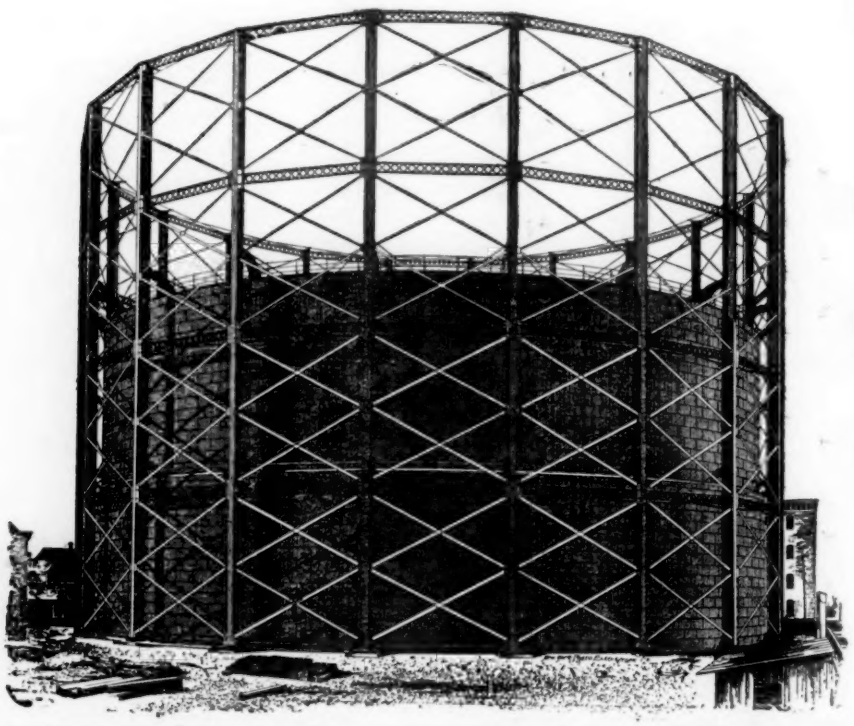

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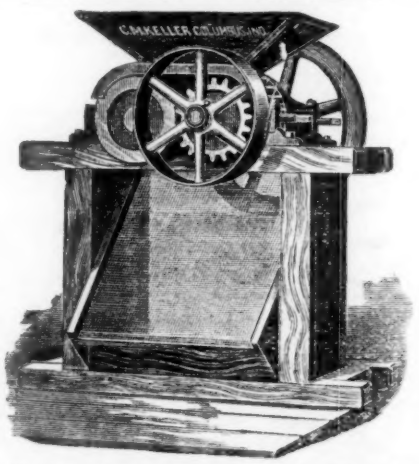

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